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Hong Kong Association
of Sports Medicine and Sports Science
香港運動醫學及科學學會

Prevention of Sports Injuries in Children

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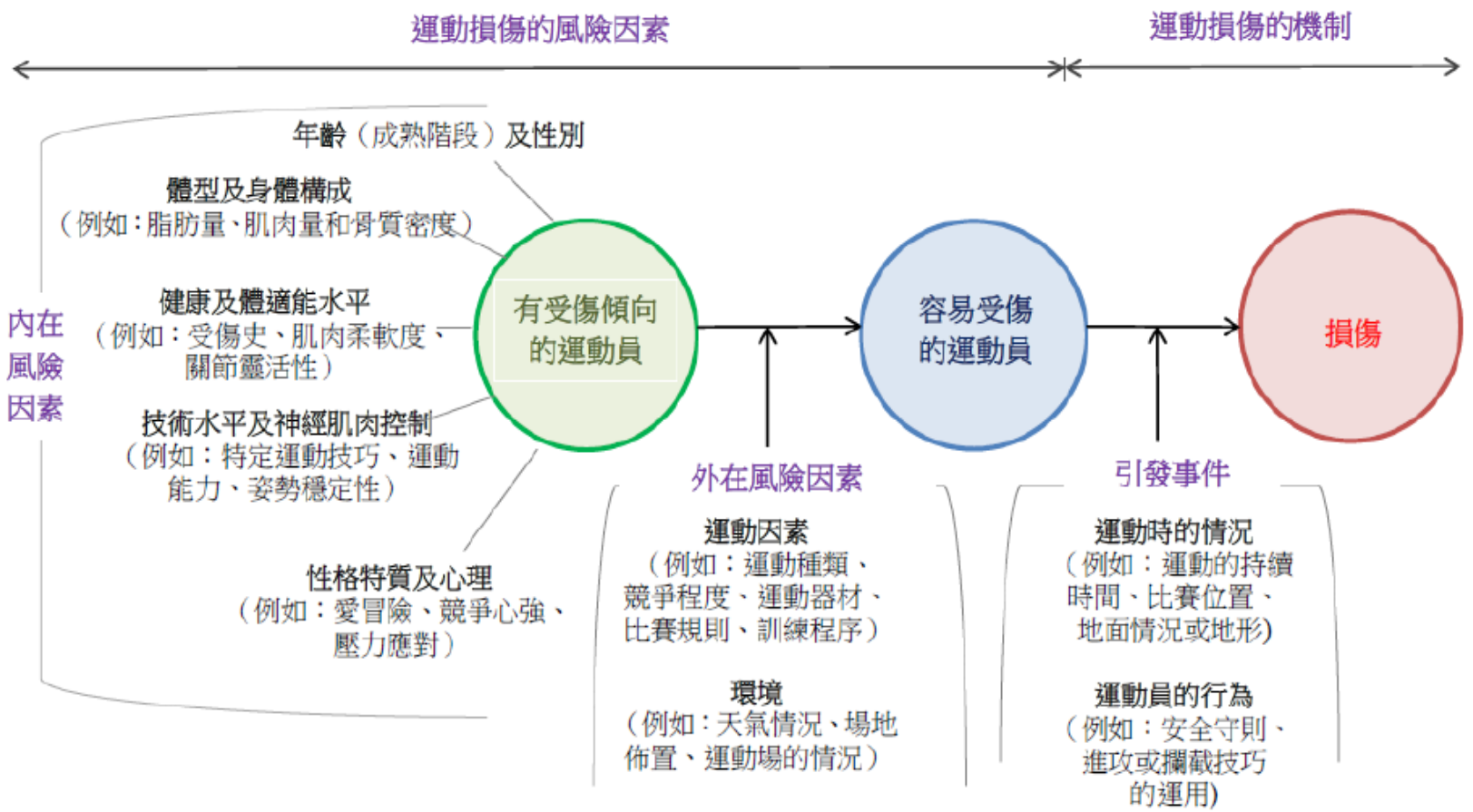
圖一：運動損傷的風險因素與引發事件之間的相互作用



（改編自一九九四年 Meeuwisse；二零零五年 Bahr 和 Krosshaug）

Epidemiology of Sports Injuries in Children

- In US, Bijur and coworkers studied 11,840 children and adolescents aged 5 to 17 years and found that 35.8% of all their injuries resulted from sports and recreational activities.
- Sports injuries: defined as time lost from the sport or school or requiring a physician's evaluation.
- The male-female ratio of injuries was 1.8:1.
- The distribution of injury type was similar in both sexes, with sprains and strains occurring most commonly, followed by fractures and/or dislocations.
- The most common causes of injury were found to be overexertion and strenuous movements, generally caused by overuse.
- Nearly half of all sports-related head injuries in adolescents and preadolescents were related to bicycle riding, skating, and skateboarding.

(source: medscape)

Common Anatomic Sites Injured

- When all sports are considered, the lower extremities are at an overall greater risk for injury than either central (back, neck, and head) or upper extremities.
- This is due to the emphasis of most sports on the lower extremities to provide locomotive power and speed to the entire body.

Common Injuries by Type in Adolescent and Preadolescent Athletes

- Overuse injuries occur from the repetitive application of submaximal stresses. This type of injury is more prevalent in the setting of organized sports, compared with backyard or pick-up games or purely recreational activities, especially in elite child athlete programs.
- Overtraining and exposure to excessive levels of physical activity can present an increased risk of injury. If not managed properly and efficiently, overuse injuries can affect normal physical growth and maturation.
- Stress fractures are a form of overuse injury, and they occur most frequently in the tibia, fibula, and pars interarticularis in young athletes
- Prevention is the key!

Common Injuries by Type in Adolescent and Preadolescent Athletes

- Shin Splints (Periostitis) is an overuse injury that occurs in athletes involved in ballistic activities and those that involve rapid deceleration

- Little League elbow is a term that describes a number of chronic overuse conditions associated with repetitive throwing that affect the skeletally immature elbow.

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BMC Musculoskeletal Disorders

RESEARCH ARTICLE Open Access

Prevalence of adolescent physical activity-related injuries in sports, leisure time, and school: the National Physical Activity Behaviour Study for children and Adolescents

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Abstract

Background: The purpose of this study was to investigate the prevalence of adolescent physical activity-related injuries in sports club activities, leisure time physical activity and school-based physical activity. The secondary aim was to investigate the differences in the prevalence of physical activity -related injuries between years 2014 and 2016. In addition, we set out to study the associations between age, sex and the frequency of physical activity and injury prevalence.

Methods: This cross-sectional study is based on the National Physical Activity Behaviour Study for Children and Adolescents (LIITU in Finnish) conducted in years 2014 and 2016. The subjects completed an online questionnaire in the classroom during school hours. A total of 8406 subjects participated in the current study. Out of these, 49% were boys and 51% were girls. The proportions of 11-, 13-, and 15-year-olds were 35%, 34% and 31%, respectively.

Results: In the combined data for 2014 and 2016, injury prevalence was higher in sports club activities (46%, 95% CI 44.8–47.8) than in leisure time PA (30%, 95% CI, 28.5–30.5) or school-based PA (18%, 95% CI, 17.4–19.1). In leisure time PA, the injury prevalence was higher than in school-based PA. In all the three settings, injury prevalence was higher in 2016 than in 2014. Frequency of PA was associated with a higher risk for PA-related injuries in sports clubs and leisure time.

Conclusions: With half of the subjects reporting at least one PA-related injury during the past year, results indicate that adolescent PA-related injuries are a large-scale problem. There is a worrisome rise in injury prevalence in recent years. From a public health standpoint, there is an urgent need to invest in injury prevention to reverse this trend.

Keywords: Athletic injury, Injury prevention, Youth, Adolescents, Safety, Physical activity

Sports clubs, Leisure PA, School-based PA

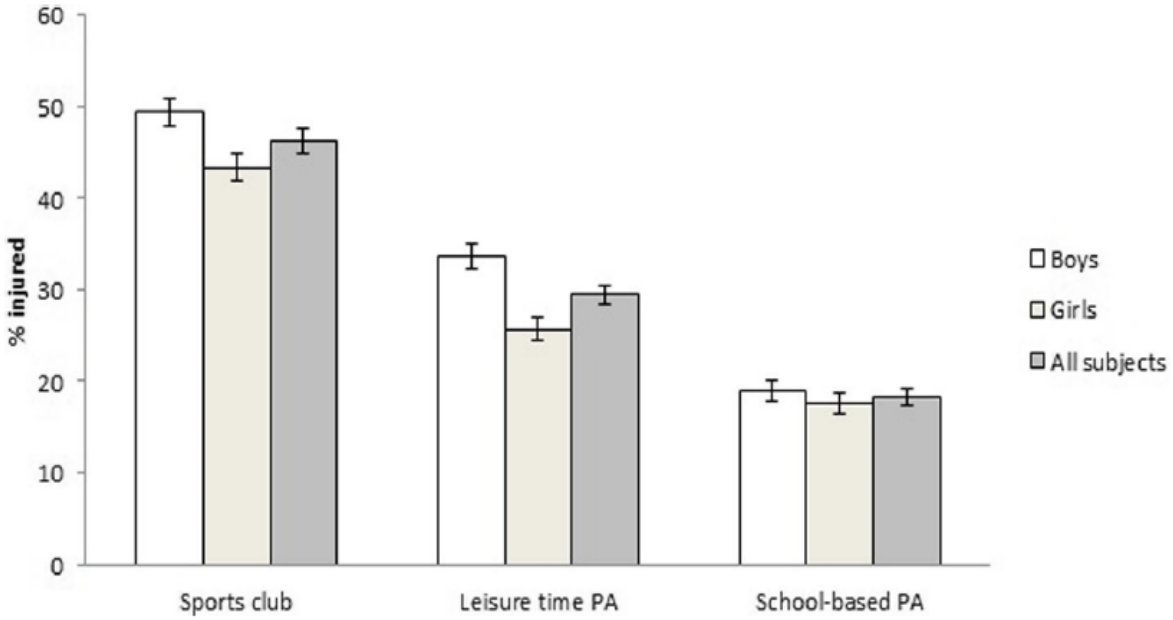

Fig. 1 Injury prevalence (%) in the total data in sports club activities, leisure time PA and school-based PA for boys, girls and all subjects presented with 95% confidence interval

Table 2 Age and sex-adjusted odds ratios (OR) and 95% confidence intervals (CI) for injuries in sports club activities and leisure time PA by frequency of activity

Frequency of PA	Sports club activities			Leisure time PA		
	OR	95% CI	*p*	OR	95% CI	*p*
Once a week or less	1			1		
2 to 3 times a week	1.39	1.16–1.66	< 0.001	1.01	0.85–1.20	0.92
4 to 5 times a week	2.29	1.90–2.75	< 0.001	1.40	1.17–1.68	< 0.001
6 to 7 times a week	3.18	2.51–4.01	< 0.001	1.62	1.34–1.96	< 0.001

Summary:

- With half of the subjects reporting at least one PA related injury during the past year, these results indicate that adolescent physical activity-related injuries are a large-scale public health problem.
- The results show a worrisome rise in injury prevalence in recent years. From a public health standpoint, there is an urgent need to invest in injury prevention to reverse this trend.
- With sport club activities gaining popularity and nearly half of the adolescents participating in sports club activities getting injured, the greatest effort should be directed there.
- Preventative measures are necessary among boys and girls equally and in all age groups.

Risk Factors for Bicycling Injuries in Children and Adolescents: A Systematic Review

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abstract

CONTEXT: Child and adolescent bicycling is beneficial, but injuries occur and can be severe and costly.

OBJECTIVE: To systematically review the individual and environmental factors associated with bicycling injury risk in children and adolescents.

DATA SOURCES: Fourteen electronic databases were searched.

STUDY SELECTION: Two authors independently assessed potentially relevant articles for eligibility. The inclusion criteria were as follows: bicyclists younger than 20 years old; examined individual and environmental characteristics of bicycling crashes; compared injured and uninjured bicyclists or bicyclists with different types or severity of injury; study designs with a predetermined comparison group; and published in English from January 1990 to May 2015. The exclusion criteria were outcomes related to helmet use, helmet legislation, or mountain biking, and comparisons of census-based injury rates.

DATA EXTRACTION: Data on study design, setting, population, injury definitions, injury risk factors, and results were extracted. Risk of bias was assessed by using the Newcastle-Ottawa Scales.

RESULTS: Fourteen articles were included. Lower socioeconomic status, riding on the road, riding in rural compared with urban areas, and riding on the sidewalk were associated with bicycling injury. Bicycling safety education did not protect children against future injury. Injuries related to a motor vehicle collision were more severe than other bicycling injuries.

LIMITATIONS: Study heterogeneity prevented meta-analyses. Study quality was affected by

CONCLUSIONS: Lower socioeconomic status and riding location were associated with bicycling injury and severity increased with motor vehicle collisions. The bicycling environment is a promising avenue for prevention.

The incidence of concussion in youth sports: a systematic review and meta-analysis

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► Additional material is published online only. To view please visit the journal online (http://dx.doi.org/10.1136/bjsports-2015-094978).

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ABSTRACT

Objective To conduct a comprehensive systematic review and meta-analysis of studies assessing the incidence of concussion in youth athletes. Specifically, we estimate the overall risk of concussion in youth sports and compare sport-specific estimates of concussion risk.

Design Systemic review and meta-analysis.

Data sources A search of Medline, Embase (1980 through September 2014), and SportDiscus (1985 through September 2014) supplemented by manual searches of bibliographies and conference proceedings.

Inclusion criteria We included studies if they met the inclusion criteria of study design (prospective cohort study), relevant sports identified from the literature (eg, American football, rugby, hockey, lacrosse, soccer/football, basketball, baseball, softball, wrestling, field hockey, track, taekwondo, volleyball and cheerleading), population (males and females ≤18 years old), and outcome (concussion).

Results Of the 698 studies reviewed for eligibility, 23 articles were accepted for systematic review and 13 of which were included in a meta-analysis. Random effects models were used to pool overall and sport-specific concussion incidence rates per 1000 athlete exposures (AEs). The overall risk of concussion was estimated at 0.23 (95% CI 0.19 to 0.28). The three sports with the highest incidence rates were rugby, hockey and American football at 4.18, 1.20 and 0.53, respectively. Lowest incidence rates per 1000 AEs occurred in volleyball, baseball and cheerleading at 0.03, 0.06 and 0.07, respectively. Quality of the included studies varied, with the majority of studies not reporting age and gender-specific incidence rates or an operational definition for concussion.

Conclusions There are striking differences in the rates of incident youth concussion across 12 sports. This systematic review and meta-analysis can serve as the current sport-specific baseline risk of concussion among youth athletes.

Concussion is a serious concern for youth athletes who engage in contact and collision sports, accounting for 3–8% of all athletes with sports-related injuries presenting to the ED.[4] Although the scientific study of concussion has progressed rapidly in recent years, the literature is still evolving.[7 8] While the literature on concussion in the adult competitive athlete has progressed dramatically, little attention has been focused on the young athlete and how this outcome varies across sports.[9 10] Adolescent concussion is a common sports injury that has been underappreciated and mishandled.[7] Evidence suggests that children and adolescents take longer to recover than adults after a concussion, often requiring a more conservative approach to management and return to play.[7] Young athletes may also be more susceptible to concussions due to a larger head to body size ratio, weaker neck muscles and/or the increased vulnerability of the developing brain.[11]

Although a systematic review of concussion incidence in contact sports has been completed, we are not aware of a systematic review evaluating concussion incidence that focuses on youth athletes. Koh and Cassidy[9] conducted a systematic review in 2002 on high school and adult competitive athletes, in which they reported an incidence rate of concussion in collegiate hockey, American football and professional rugby. This systematic review is over 10 years old and given the increased risk and growing concern for youth athletes, we performed a systematic review and meta-analysis of observational cohort studies reporting on the incidence of concussion among male and female adolescent athletes aged 18 years and younger. The primary aim was to estimate the overall risk of concussion in youth athletes participating in any sport and to compare sport-specific estimates of concussion risk across sports.

Summary

- Of the 698 studies reviewed for eligibility, 23 articles were accepted for systematic review and 13 of which were included in a meta-analysis.
- Random effects models were used to pool overall and sport-specific concussion incidence rates per 1000 athlete exposures (AEs).
- The overall risk of concussion was estimated at 0.23 (95% CI 0.19 to 0.28).
- The three sports with the highest incidence rates were rugby, hockey and American football at 4.18, 1.20 and 0.53, respectively.
- Lowest incidence rates per 1000 AEs occurred in volleyball, baseball and cheerleading at 0.03, 0.06 and 0.07, respectively.

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Routledge
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Should heading be forbidden in children's football?

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ABSTRACT

Background: Football (soccer) is the most popular sports in children and adolescents worldwide. While it has been embraced as a low-risk-for-injury sport, discussions about potential long-term effects have emerged. As part of a legal settlement, the US Soccer Federation has issued a ban for heading in children aged 10 years and younger in 2015.

Purpose: What is the scientific evidence for this decision and should other countries adapt it?

Main findings: When reviewing the literature, it becomes evident that data on acute and persistent effects of heading and head-related injuries is inconclusive and hampered by limitations. These include recall biases, flaws in statistical analyses and inappropriate assessments of heading-frequency and head-injuries – mainly performed retrospectively via questionnaires. Epidemiologic data indicates that the majority of head-injuries is due to contact with other players (35–75%) followed by surfaces/objects (13–32%) and ball-contact (20–30%).

Conclusions: Overall, current evidence seems insufficient to support a ban of heading in children's football. Until more solid data is available, heading should not be started before children confirm to be ready to do so. Then, heading should be introduced stepwise and controlled using structured heading training focusing on technical aspects. Whether this should be at age 11 years or earlier needs to be determined.

ARTICLE HISTORY
Accepted 25 September 2017

KEYWORDS
Soccer; long-term effects; head injury; personal view; neurocognitive deficits

Soccer Injuries in Players Aged 7 to 12 Years

A Descriptive Epidemiological Study Over 2 Seasons

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Investigation performed at the Department of Sport, Exercise and Health, University of Basel, Basel, Switzerland, and the Department of Orthopaedics, 1st Faculty of Medicine, Charles University and Hospital, Prague, Czech Republic

Background: As part of a risk-management approach, sound epidemiological data are needed to develop prevention programs. A recent review on soccer injuries of players younger than 19 years concluded that prospective data concerning children are lacking.

Purpose: To analyze the incidence and characteristics of soccer injuries in children aged 7 to 12 years.

Study Design: Descriptive epidemiological study.

Methods: The present survey was a prospective descriptive epidemiological study on soccer injuries over 2 seasons in the Czech Republic and Switzerland. Exposure of players during training and match play (in hours) and injury data were reported by coaches via an Internet-based registration system. Location, type, and severity of injuries were classified according to an established consensus. Injury characteristics are presented as absolute numbers and injury incidence rates (injuries per 1000 hours of soccer exposure). An injury was defined as any physical complaint sustained during a scheduled training session or match play resulting in at least 1 of the following: (1) inability to complete the current match or training session, (2) absence from subsequent training sessions or matches, and (3) injury requiring medical attention.

Results: In total, 6038 player-seasons with 395,295 hours of soccer exposure were recorded. The mean (±SD) age of the players was 9.5 ± 2.0 years, and 3.9% of the participants were girls. A total of 417 injuries were reported. Most (76.3%) injuries were located in the lower limbs, with 15.6% located in the upper limbs. Joint and ligament injuries comprised 30.5%, contusions 22.5%, muscle and tendon injuries 18.5%, and fractures and bone injuries 15.4% of all injuries; 23.7% of injuries led to more than 28 days of absence from sport participation. The overall injury incidence was 0.61 (95% CI, 0.53-0.69) injuries per 1000 hours of soccer exposure during training sessions and 4.57 (95% CI, 4.00-5.23) during match play. Injury incidence rates increased with increasing age.

Conclusion: The observed injury incidences were lower compared with studies in youth players. Children showed a relatively high proportion of fractures and bone stress and of injuries to the upper limbs.

Clinical Relevance: The study provides an evidence base for injury incidence rates and injury characteristics in children's soccer. These data are the basis to develop an age-specific injury-prevention program.

Soccer injuries in children

TABLE 4
Type of Injury and Related Comparison of Incidence in Different Age Groups

Category	Total, N (%)	7-8 y, n (%)	9-10 y, n (%)	11-12 y, n (%)	9-10 vs 7-8 y, RR (95% CI)	11-12 vs 9-10 y, RR (95% CI)	11-12 vs 7-8 y, RR (95% CI)
Fracture	42 (10.1)	6 (10.7)	12 (10.4)	24 (9.8)	1.48 (0.56-3.95)	2.15 (1.07-4.29)	3.19 (1.30-7.80)
Other bone injuries	22 (5.3)	1 (1.8)	4 (3.5)	17 (6.9)	2.97 (0.33-26.55)	4.56 (1.54-13.56)	13.54 (1.80-101.76)
Dislocation/subluxation	12 (2.9)	3 (5.4)	3 (2.6)	6 (2.4)	0.74 (0.15-3.68)	2.15 (0.54-8.59)	1.59 (0.40-6.37)
Sprain/ligament injury	86 (20.6)	14 (25.0)	25 (21.7)	47 (19.1)	1.32 (0.69-2.55)	2.02 (1.24-3.28)	2.67 (1.47-4.86)
Inflammation/overuse of joint	27 (6.5)	3 (5.4)	9 (7.8)	15 (6.1)	2.23 (0.60-8.22)	1.79 (0.78-4.09)	3.98 (1.15-13.76)
Lesion of meniscus or cartilage	2 (0.5)	0	2 (1.7)	0			
Muscle rupture/tear/strain/cramps	70 (16.8)	7 (12.5)	11 (9.6)	52 (21.1)	1.17 (0.45-3.01)	5.08 (2.65-9.73)[a]	5.92 (2.69-13.03)[a]
Tendon injury/rupture/tendinosis/bursitis	7 (1.7)	1 (1.8)	2 (1.7)	4 (1.6)	1.48 (0.13-16.36)	2.15 (0.39-11.73)	3.19 (0.36-28.51)
Hematoma/contusion/bruise	94 (22.5)	12 (21.4)	27 (23.5)	55 (22.4)	1.67 (0.85-3.29)	2.19 (1.38-3.47)[a]	3.65 (1.96-6.82)[a]
Abrasion	6 (1.4)	2 (3.6)	1 (0.9)	3 (1.2)	0.37 (0.03-4.09)	3.22 (0.34-30.97)	1.19 (0.20-7.15)
Laceration	3 (0.7)	1 (1.8)	1 (0.9)	1 (0.4)	0.74 (0.05-11.86)	1.07 (0.07-17.17)	0.80 (0.05-12.74)
Concussion	8 (1.9)	0	5 (4.3)	3 (1.2)		0.64 (0.15-2.70)	
Other injuries	38 (9.1)	6 (10.7)	13 (11.3)	19 (7.7)	1.61 (0.61-4.23)	1.57 (0.78-3.18)	2.52 (1.01-6.32)
Total	417 (100.0)	56 (100.0)	115 (100.0)	246 (100.0)	1.52 (1.11-2.10)	2.30 (1.84-2.87)[a]	3.50 (2.62-4.68)[a]

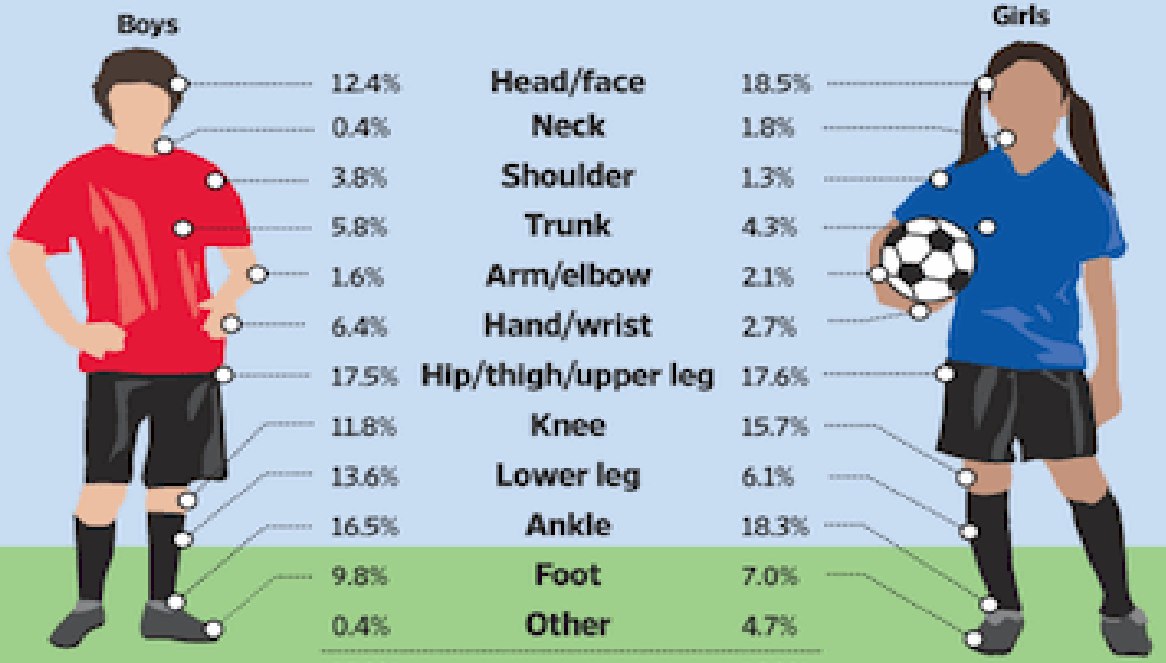
[a] $P < .001$.

TABLE 6
Injury Location and Injury Type

	No. of Injuries							
	Fractures and Bone Stress	Joint (Nonbone) and Ligament	Muscle and Tendon	Hematoma, Contusion, Bruise	Laceration and Skin Lesion	Concussion	Other	Total
Head/face				6	6	8	6	26
Shoulder/clavicle	3	3		3			1	10
Upper arm	2							2
Elbow	1			3				4
Forearm	5							5
Wrist	8	8		2				18
Hand/finger/thumb	9	12		4			1	26
Sternum/ribs/upper back	1			2			1	4
Lower back/pelvis/sacrum				2			2	4
Hip/groin		4	33	1			3	41
Thigh			31	8	1		1	41
Knee	5	34		18	2		9	68
Lower leg/Achilles tendon	2		12	10			5	29
Ankle	4	61		20			2	87
Foot/toe	24	5	1	15			7	52
Total	64	127	77	94	9	8	38	417

Where Boys and Girls Get Hurt

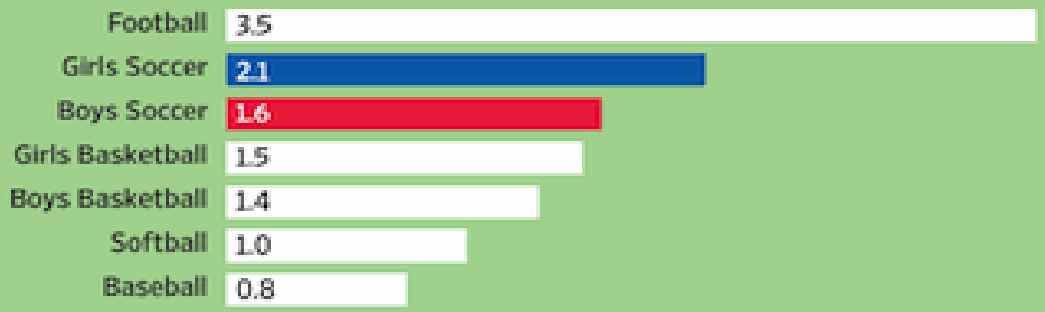
Soccer injuries in high schoolers



Boys		Girls
12.4%	Head/face	18.5%
0.4%	Neck	1.8%
3.8%	Shoulder	1.3%
5.8%	Trunk	4.3%
1.6%	Arm/elbow	2.1%
6.4%	Hand/wrist	2.7%
17.5%	Hip/thigh/upper leg	17.6%
11.8%	Knee	15.7%
13.6%	Lower leg	6.1%
16.5%	Ankle	18.3%
9.8%	Foot	7.0%
0.4%	Other	4.7%
100%		100%

How Dangerous Is Each Sport?

Injuries per 1,000 times a player takes the field



Source: Center for Injury Research and Policy at Nationwide Children's Hospital

AOSSM Early Sport Specialization Consensus Statement

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Background: Early sport specialization is not a requirement for success at the highest levels of competition and is believed to be unhealthy physically and mentally for young athletes. It also discourages unstructured free play, which has many benefits.

Purpose: To review the available evidence on early sports specialization and identify areas where scientific data are lacking.

Study Design: Think tank, roundtable discussion.

Results: The primary outcome of this think tank was that there is no evidence that young children will benefit from early sport specialization in the majority of sports. They are subject to overuse injury and burnout from concentrated activity. Early multisport participation will not deter young athletes from long-term competitive athletic success.

Conclusion: Youth advocates, parents, clinicians, and coaches need to work together with the sport governing bodies to ensure healthy environments for play and competition that do not create long-term health issues yet support athletic competition at the highest level desired.

Keywords: early sports specialization; consensus; youth sports

American Orthopaedic Society for Sports Medicine (AOSSM)

DEFINITION OF EARLY SPORTS SPECIALIZATION :

1. Participation in intensive training and/or competition in organized sports greater than 8 months per year (essentially year round)
2. Participation in 1 sport to the exclusion of participation in other sports (limited free play overall)
3. Involving prepubertal (seventh grade or roughly age 12 years) children.

Overuse injuries and burnout in youth sports: a position statement from the American Medical Society for Sports Medicine

John P DiFiori,[1] Holly J Benjamin,[2] Joel S Brenner,[3] Andrew Gregory,[4] Neeru Jayanthi,[5] Greg L Landry,[6] Anthony Luke[7]

Background

Youth sport participation offers many benefits including the development of self-esteem, peer socialisation and general fitness. However, an emphasis on competitive success, often driven by goals of elite-level travel team selection, collegiate scholarships, Olympic and National team membership and even professional contracts, has seemingly become widespread. This has resulted in an increased pressure to begin high-intensity training at young ages. Such an excessive focus on early intensive training and competition at young ages rather than skill development can lead to overuse injury and burnout.

Purpose

Epidemiology

It is estimated that 27 million US youth between 6 and 18 years of age participate in *team* sports. The National Council of Youth Sports survey found that 60 million children aged 6–18 years participate in *some form* of organised athletics, with 44 million participating in more than one sport. There is very little research specifically on the incidence and prevalence of overuse injuries in children and adolescents. Overall estimates of overuse injuries versus acute injuries range from 45.9% to 54%. The prevalence of overuse injury varies by the specific sport, ranging from 37% (skiing and handball) to 68% (running). Overuse injuries are underestimated in the literature because most of the epidemiological studies define injury as requiring a time loss from participation.

NBA, USA Basketball recommend no three-pointers for players 11-and-under

- Smaller basketballs,
- lower rims,
- no zone defense,
- no three-point scoring for players 11 years old and younger.

Box 1 Categorisation of risk factors for overuse injury

Intrinsic risk factors
Growth-related factors
Susceptibility of growth cartilage to repetitive stress
Adolescent growth spurt
Previous injury
Previous level of conditioning
Anatomical factors
Menstrual dysfunction
Psychological and developmental factors—athlete-specific
Extrinsic risk factors
Training workload (rate, intensity and progression)
Training and competition schedules
Equipment/footwear
Environment
Sport technique
Psychological factors—adult and peer influences
(Adapted from DiFiori.[15])

DiFiori JP, *et al*. *Br J Sports Med* 2014;**48**:287–288. doi:10.1136/bjsports-2013-093299

American Medical Society for Sports Medicine

Recommendations for avoiding burnout and injury:

- Avoiding overscheduling and excessive time Commitments.
- Consider using a valid and reliable tool to monitor Burnout.
- Emphasize skill development and fun.
- Emphasize lifelong physical activity skills.

Box 2 Factors related to burnout in young athletes[185 188 207]

Environmental factors

Extremely high training volumes
Extremely high time demands
Demanding performance expectations (imposed by self or significant other)
Frequent intense competition
Inconsistent coaching practices
Little personal control in sport decision making
Negative performance evaluations (critical instead of supportive)

Personal characteristics

Perfectionism
Need to please others
Non-assertiveness
Unidimensional self-conceptualisation (focusing only on one's athletic involvement)
Low self-esteem
High perception of stress (high anxiety)

Box 3 Diagnosis of overtraining syndrome/ burnout[180 208]

History

Decreased performance persisting despite weeks to months of recovery

Disturbances in mood

Lack of signs/symptoms or diagnosis of other possible causes of underperformance

Lack of enjoyment participating in sport

Inadequate nutritional and hydration intake

Presence of potential triggers: (a) increased training load with adequate recovery, (b) monotony of training, (c) excessive number of competitions, (d) sleep disturbance, (e) stressors in family life (parental pressure), (f) stressors in sporting life (coaching pressure and travel demands), (g) previous illness.

Testing (if indicated by history)

Consider laboratory studies: complete blood count, comprehensive metabolic panel, erythrocyte sedimentation rate, C reactive protein, iron studies, creatine kinase, thyroid studies, cytomegalovirus and Epstein-Barr virus titres.

Profile of Mood States (POMS): a psychometric tool for a global measure of mood, tension, depression, anger, vigour, fatigue and confusion.[179]

Symptoms ?

Table 4 Symptoms of overtraining syndrome/burnout[180 188 207]

Fatigue	Insomnia	Loss of appetite
Depression	Irritability	Weight loss
Bradycardia or tachycardia	Agitation	Lack of mental concentration
Loss of motivation or interest	Decreased self-confidence	Heavy, sore, stiff muscles
Hypertension	Anxiety	Restlessness
Sleep disturbances	Nausea	Frequent illness

Summary statements：

1. Overuse injuries are under-reported in the current literature because most of the injury definitions have focused on time loss from sport;

2. Preparticipation examinations may identify prior injury patterns and provide an opportunity to assess sport readiness;

3. A history of prior injury is an established risk factor for overuse injuries and should be noted as part of each injury Assessment;

4. Adolescent female athletes should be assessed for menstrual dysfunction as a potential predisposing factor to overuse Injury.

Summary statements：

5. Parents and coaches should be educated regarding the concept of sport readiness. Variations in cognitive development, as well as motor skills, should be considered when setting goals and expectations.

6. Early sport specialisation may not lead to long-term success in sports, and may increase risk for overuse injury and burnout. With the exception of early entry sports such as gymnastics, figure skating and swimming/diving, sport diversification should be encouraged at younger ages.

7. When an overuse injury is diagnosed, it is essential to address the underlying cause(s). The athlete, parents and coaches should be involved in reviewing all risk factors and developing a strategy to attempt to avoid recurrent injury.

8. All overuse injuries are not inherently benign. Clinicians should be familiar with specific high-risk injuries, including stress fractures of the femoral neck, tarsal navicular, anterior tibial cortex and physis and effort thrombosis.

EDITOR'S CHOICE

Injury prevention in paediatric sport-related injuries: a scientific approach

C A Emery[1,2,3]

Youth have very high participation rates in sport, and sport is the leading cause of youth injury in many countries.[1–7] Canadian studies report that 30–40% of youth (ages 11–18 years) seek medical attention for a sport injury annually.[2 7] While physical activity prevents all-cause morbidity associated with a sedentary lifestyle, injuries can become a barrier to physical activity. Injury prevention in youth is a critical issue in healthcare and in the promotion of health and wellness in our communities, and is becoming a public health priority.[8–9] However, there is a discrepancy between the amount of research in this area and the public health burden of injury in youth sport where injuries are often predictable and preventable.

FRAMEWORK FOR INJURY-PREVENTION RESEARCH

Sixty years ago, Gordon[11] established the use of epidemiological principles often used to study infectious diseases, to examine injury and relate it to host, agent, and environmental factors. Gibson[12] built on this concept by identifying the agent of injury as physical energy (ie, mechanical, thermal, chemical or electrical) and further examining the reduction in tissue damaging transfer of physical energy to the human body. Haddon[13] extended this notion through the construction of a two-dimensional matrix describing injury countermeasures. The first axis relates to temporality (ie, pre-event, event and postevent.)[13] The

which the intervention context is established to inform implementation strategies and TRIPP stage 6 in which the effectiveness of preventive measures are evaluated in the implementation context.[18] Finch highlights translating research into the real-world context considering the current safety practices, motivations/barriers to uptake and player behaviours and sporting culture.

Meeuwisse[19] established the sport injury event along a continuum in which there exists a complex interaction between intrinsic risk factors (eg, age, strength, previous injury) and exposure to extrinsic risk factors (eg, field conditions, equipment) that affect susceptibility to injury. An inciting event will ultimately produce an injury in a susceptible sport participant.[19] Bahr and Krosshaug[20] built on this model to highlight the mechanism of injury including biomechanical components, the playing situation and player/opponent behaviour. Meeuwisse *et al*[21] build further on this model in light of limitations with the implicit linear paradigm (fig 1). The approach often used in injury prevention studies involves following individuals, exposed to some risk factor(s) and/or intervention over time,

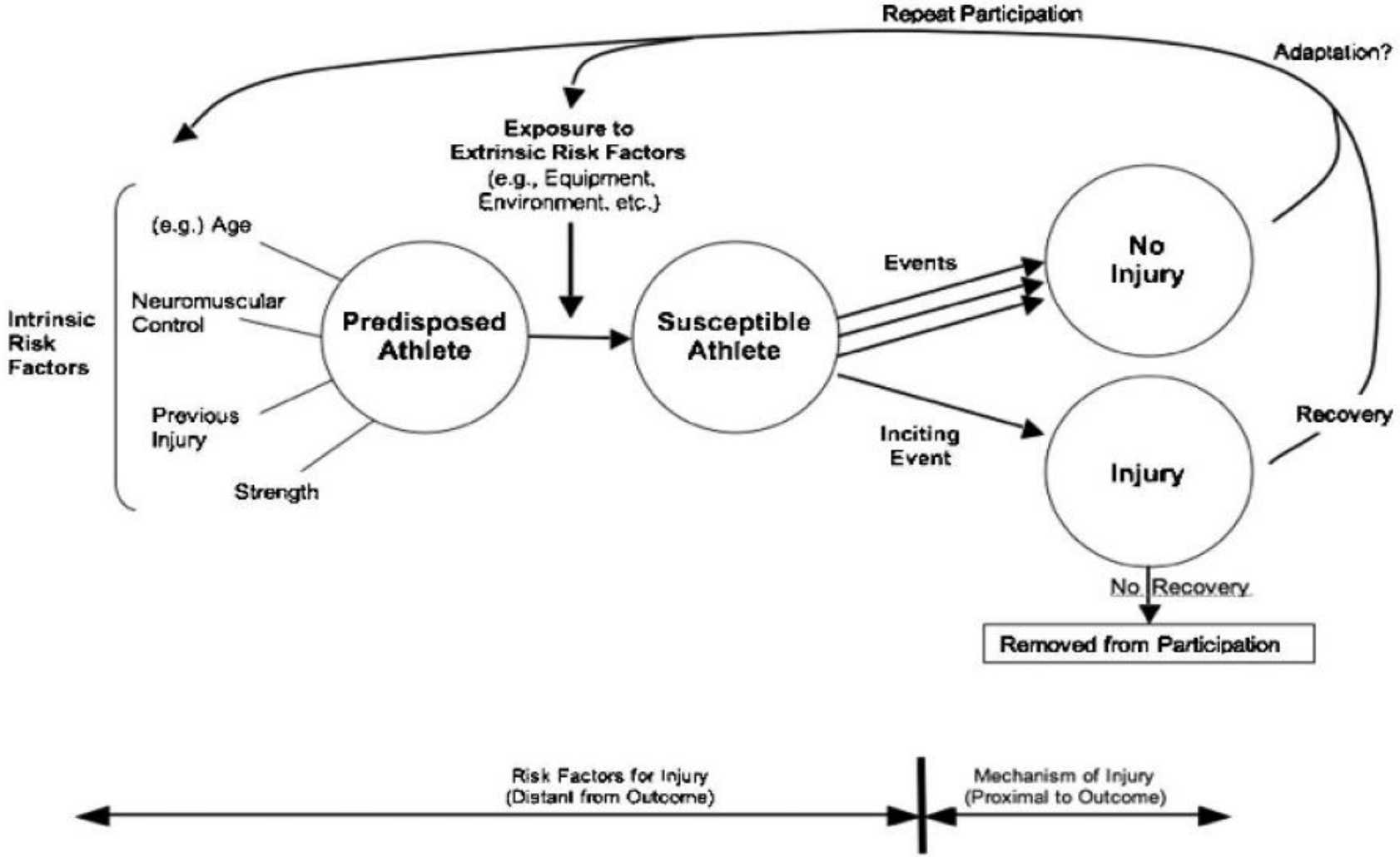

Figure 1 Dynamic, recursive model of aetiology in sport injury (reproduced with permission from Meeuwisse *et al*[21]).

Commentary

What is already known on the topic

- There is an increasing body of evidence in the literature that examines the public health impact and risk factors for injury in youth sport.
- A model for a scientific approach to research in injury prevention in sport has been developed but has not been a significant focus to date in injury prevention in youth sport.
- The evidence for injury prevention based on the evaluation of prevention strategies in youth sport is emerging, but a minimal focus to date has been placed on the methodological approach to research design, measurement and analysis.

What this paper adds

- This paper advocates for a scientific approach to research in injury prevention in child and adolescent sport with an increasing need to focus on evaluation research.
- Methodological considerations are highlighted that are necessary to provide scientific evidence to inform practice and policy in injury prevention most appropriately in youth sport.

Theisen D[1], Malisoux L[1], Seil R[1,2], Urhausen A[1,2]

Injuries in Youth Sports: Epidemiology, Risk Factors and Prevention

Verletzungen im Jugendsport: Epidemiologie, Risikofaktoren und Prävention

[1] Sports Medicine Research Laboratory, Public Research Centre for Health, Luxembourg, Großherzogtum Luxemburg
[2] Sports Clinic, Centre Hospitalier de Luxembourg, Luxembourg, Großherzogtum Luxemburg

SUMMARY

Organised youth sport has become increasingly professionalised, and the associated sports injury problem has received much attention lately. Sports injury prevention should rely on permanent surveillance and encompass the collection of epidemiological data, the establishment of risk factors, the implementation of

ZUSAMMENFASSUNG

Der organisierte Jugendsport hat sich in den vergangenen Jahren zunehmend professionalisiert. Dem damit verbundenen Problem der Sporverletzungen wurde hierdurch zunehmend Aufmerksamkeit verliehen. Die Prävention von Sportverletzungen sollte auf einer permanenten Überwachung basieren, welche die

Table 1: Potential risk factors involved in sports injury causation.

	Modifiable	Non-modifiable
Intrinsic	Fitness level	Age
	Sport-specific training/warm-up	Gender
	Muscle strength	Maturity level
	Flexibility	Previous injury
	Joint stability	
	Biomechanical factors	
	Balance/proprioception	
	Psychological factors	
Extrinsic	Rules and regulations	Type of sport
	Coaching education/training	Sport context
	Playing time	Weather conditions
	Playing surface	Level of play
	Equipment	Time of season
		Playing position

Summary:

- Organised youth sport has become increasingly professionalized, and the associated sports injury problem has received much attention lately.
- Sports injury prevention should rely on permanent surveillance and encompass the collection of epidemiological data, the establishment of risk factors, the implementation of prevention initiatives and the analysis of their effectiveness.
- Overall, injury incidence in youth sport is usually within a range of 1-10 injuries/1000 hours. About one fifth of all injuries are severe, implying a withdrawal from normal sport activity for at least 4 weeks, while up to 20 % of all injuries are recurrences.

Summary

- Chronic overuse injuries amount to up to 40%, many of which concern episodes of traction apophysites, typical in youth sports.
- Risk factors can be extrinsic (e.g. sport context) or intrinsic (e.g. gender), modifiable (e.g. neuro-muscular control) or non-modifiable (e.g. previous injury).
- Injury risk is higher in team compared to individual sports and in competition compared to training.
- Active sports injury prevention initiatives have been introduced and tested in a number of controlled studies. Putting aside a possible publication bias, most results are encouraging, showing a possible reduction of injuries by 50 % on average.

Open Access Review

BMJ Open Sport & Exercise Medicine

Prevention of sports injuries in children at school: a systematic review of policies

Anya Göpfert,[1] Maria Van Hove,[2] Alan Emond,[1] Julie Mytton[3]

To cite: Göpfert A, Van Hove M, Emond A, *et al*. Prevention of sports injuries in children at school: a systematic review of policies. *BMJ Open Sport & Exercise Medicine* 2018;**4**:e000346. doi:10.1136/bmjsem-2018-000346

▶ Additional material is

ABSTRACT

Background Participation in sports as a child improves physical and psychological health. Schools need to promote sport while protecting against injury. It is not clear whether increasing evidence on injury prevention generated from professional sport is influencing school sports practices. This study reviewed policies promoting sport safety in schools to determine whether exposure to injury risk is recognised and whether evidence based

What is already known on this topic?

- Sporting injuries can have significant effects on society and individuals. Schools often follow health and safety guidance, yet practice is infrequently based on research evidence. Effective interventions for preventing injuries exist.

ABSTRACT

Background Participation in sports as a child improves physical and psychological health. Schools need to promote sport while protecting against injury. It is not clear whether increasing evidence on injury prevention generated from professional sport is influencing school sports practices. This study reviewed policies promoting sport safety in schools to determine whether exposure to injury risk is recognised and whether evidence based prevention and management are included.

Methods A search strategy to identify policies for children aged 4–18 years was applied to electronic databases and grey literature sources. Safeguarding policies were excluded. Included policies were critically appraised and synthesised using modified framework analysis.

Results Twenty-six policies were analysed. Most (57.7%) were from the USA. Ten (38.5%) focused solely on concussion. Synthesis identified primary, secondary and tertiary injury prevention measures relating to people (staff, students and parents), systems, school physical environment and national-level factors.

Conclusions Robust, evidence-based policies for reducing injury risk in school sports are limited. Guidelines with the largest evidence base were focused on concussion, with other school sport guidelines showing limited inclusion of evidence. Where included, evidence focused on injury management rather than prevention and frequently applied evidence from adult to children. Guidance was not specific to the child's age, gender or developmental stage.

香港學校體育學習領域

安全指引

香港特別行政區政府
教育局
體育組編訂
二零一一年

(網上版更新日期：2016年7月)

引言

本手冊旨在提供一些安全指引，以協助學校在進行體育課及相關活動時，防止意外發生。

一般而言，運動的安全程度，可以透過小心安排、詳細策畫及充分準備而加以提高。良好的觀察能力和認真的教學態度，亦能減少意外發生。

由於環境不同，情況各異，本手冊不能涵蓋所有體育活動，教師應運用其專業知識，並根據本手冊具列的原則和安全建議，作出客觀、合理的判斷，以及採取適當的措施。

如欲查詢本手冊內容，請與本局體育組聯絡。有關個別運動項目的資料，亦可向相關體育總會及有關專業團體查詢；至於戶外活動(如野外定向、單車、風帆、獨木舟、賽艇、帆船等)的安全措施，請參考本局發出的《戶外活動指引》，網址:

http://www.edb.gov.hk/tc/sch-admin/admin/about-activities/sch-activities-guidelines/，或與本局教育統籌委員會及策劃分部延伸支援計劃組聯絡。

歡迎學校對本手冊提出意見和建議，來函請寄：

香港北角渣華道323號3樓
教育局課程發展處
總課程發展主任(體育)
電郵：pe@edb.gov.hk

目錄

6. 當「空氣質素健康指數」或指數預報達至下列級別，特別在交通繁忙地方，須注意學生在受影響地區進行體力消耗或戶外活動的安排:

健康風險	級別	環境保護署的健康忠告	教育局對學校的建議
高	7	**減少**戶外體力消耗和**減少**在戶外逗留的時間	體育活動/運動的強度及時間可維持於中等程度
甚高	8-10	**盡量減少**戶外體力消耗和**盡量減少**在戶外逗留的時間	體育活動/運動的強度及時間應維持於中至低等程度
嚴重	10+	**避免**戶外體力消耗和**避免**在戶外逗留	避免體力消耗活動及在戶外逗留

有關「空氣質素健康指數」的資料，請參閱教育局網頁: http://www.edb.gov.hk/tc/curriculum-development/kla/pe/references_resource/index.html 或環境保護署空氣質數健康網頁: http://www.aqhi.gov.hk/tc.html.

第八章 體操和彈網

（閱讀本章內容前，宜先熟讀第一章）

一、 教師資格

曾考獲中國香港體操總會的初級金章或教育局認可資歷的人，方可教授彈網活動。

二、 教學考慮

一般注意事項

1. 應制定合適的教學進度，並讓學生了解清楚有關動作的學習要點。
2. 應提高學生安全意識，同時亦須禁止他們作出互相逞強的行為。
3. 應教導學生穿著合適的衣履，並且不可佩戴飾物和手錶進行體操活動。
4. 應教導學生在練習前作充分的熱身準備。
5. 應教導學生進行適當的輔助練習，提高柔軟度和力量，以協助學習各種體操技術。
6. 應教導學生充分運用空間，避免互相阻礙和碰撞。
7. 有需要時，可在器材上加上護墊，以避免身體直接撞擊器材，並提供鎂粉、護掌等給學生使用。
8. 教授體操技術時，應同時教授相關的正確保護法。
9. 應教導學生搬運、裝拆和檢查器材的正確方法。任何時候，不可使用損壞或不穩固的器材。
10. 應禁止過多學生同時使用同一器材，以免發生危險。
11. 切勿在體育課教授空翻。
12. 切勿在體育課教授技巧體操中的拋接隊員動作。

第十一章　游泳課和游泳訓練

（閱讀本章內容前，宜先熟讀第一章）

一、 教師資格

教師

1. 具備拯溺資格(銅章或以上救生證書)的體育教師，均可教授游泳課。

助教

2. 如有需要，校方可安排助教，以協助教授游泳課/活動。助教須由持有效拯溺證書（銅章或以上）的人士擔任。

二、 教學考慮

師生比例

1. 每位教師在同一時段最多可負責教授或訓練四十五名學生。
2. 應常查核學生人數，尤以授課前、後更為重要。

游泳裝備

3. 學生須佩戴泳帽或手帶，以便識別。

水上安全

4. 教學位置及視線應能顧及全班學生。
5. 除在緊急情況或要進行水中示範外，教師不應進入水中；當教師在水中示範時，學生應離開水面。
6. 應教導學生水上學習安全知識和泳池規則，包括不應在池邊奔跑或在泳池範圍內胡鬧嬉戲。
7. 應採用「同伴制」、「按能力分組」等方式教授游泳課/活動；並須教導學生遇到意外時，同伴或其他同學應立即通知教師。
8. 學生如身體有傷口或患有傳染性疾病，例如皮膚病、紅眼症、手足口病等，不應參與游泳活動。
9. 須確保學生在未獲得教師准許前不得下水，並於課後全部離開池面，在泳池範圍外解散。
10. 於泳池分段休息時間使用康樂及文化事務署泳池時，須自行安排一位持有效拯溺銅章或以上資格的人士，協助照顧學生。

第十三章　拔河比賽

(閱讀本章內容前，宜先熟讀第一章)

一、 教師資格

負責或協助組織拔河比賽的人須具備相關的資格和經驗。

二、 一般措施

1. 身體不適或患有心血管病或慣性脫臼的學生不可參加。
2. 凡未滿十五周歲的學生不應參加。
3. 每隊比賽的人數不應超過 8 名。
4. 學生宜穿著長袖衣服、適當鞋履、護肘、護膝等。
5. 應訂定規則，包括時限，以避免雙方爭持過久。
6. 比賽前，學生應做熱身和針對性的伸展動作。
7. 比賽時，同隊學生需有節奏地發力和呼吸，不應長時間「閉氣」。
8. 比賽期間，學生不可無故突然鬆手或刻意搖晃繩子。
9. 當裁判宣佈比賽結束時，雙方隊員應慢慢放開繩子。

三、 環境與設施

1. 溫度和濕度較高的時段，不宜進行拔河比賽。
2. 比賽範圍應有足夠的安全空間和緩衝區。
3. 凹凸不平、過於粗糙、滑溜或濕滑的場地，皆不適宜舉行拔河比賽。

附錄十一

戶外活動指引簡介

(http://www.edb.gov.hk/tc/sch-admin/admin/about-activities/sch-activities-guidelines/)

戶外活動的定義：

戶外活動泛指由學校策劃、組織， 並由校方委任的教師/導師督導學生於大自然環境中參與一些具探索性、挑戰性和體力要求的陸上或水上活動。

內容：

引言

第一章 校長、教師/導師須知
第二章 陸上活動一般措施
第三章 遠足
第四章 遠征訓練
第五章 露營
第六章 野外定向
第七章 單車
第八章 實地/野外研習
第九章 水上活動一般措施
第十章 滑浪風帆
第十一章 獨木舟
第十二章 賽艇
第十三章 帆船

Sports Injury Prevention Tips

- Take time off. Plan to have at least 1 day off per week and at least one month off per year from training for a particular sport to allow the body to recover.
- Wear the right gear. Players should wear appropriate and properly fit protective equipment such as pads (neck, shoulder, elbow, chest, knee, shin), helmets, mouthpieces, face guards, protective cups, and eyewear. Young athletes should not assume that protective gear will prevent all injuries while performing more dangerous or risky activities.
- Strengthen muscles. Conditioning exercises during practice strengthens muscles used in play.
- Increase flexibility. Stretching exercises after games or practice can increase flexibility. Stretching should also be incorporated into a daily fitness plan.
- Use the proper technique. This should be reinforced during the playing season.

- Take breaks. Rest periods during practice and games can reduce injuries and prevent heat illness.
- Play safe. Strict rules against headfirst sliding (baseball and softball), spearing (football), and checking (in hockey) should be enforced.
- Do not play through pain.
- Avoid heat illness by drinking plenty of fluids before, during and after exercise or play; decrease or stop practices or competitions during high heat/humidity periods; wear light clothing.
- If children are jumping on a trampoline, they should be supervised by a responsible adult, and only one child should be on the trampoline at a time; 75% of trampoline injuries occur when more than one person is jumping at a time.

(source: American Academy of Pediatrics)

Sports-Related Emotional Stress

- The pressure to win can cause significant emotional stress for a child. Sadly, many coaches and parents consider winning the most important aspect of sports.
- Young athletes should be judged on effort, sportsmanship and hard work. They should be rewarded for trying hard and for improving their skills rather than punished or criticized for losing a game or competition.
- The main goal should be to have fun and learn lifelong physical activity skills.

Love Sports, Play SMART