

# 2017

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## The Evidence-Based Prevention and Promotion of Athletic Health

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# Collaborative Works between Yonsei University & WTF

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Yonsei University

Presented by

IOC Research Centre  
for Prevention of Injury and Protection of Athlete Health

YISSEM

Yonsei Institute of Sports Science & Exercise Medicine



Department of Physical Education



WORLD TAEKWONDO FEDERATION



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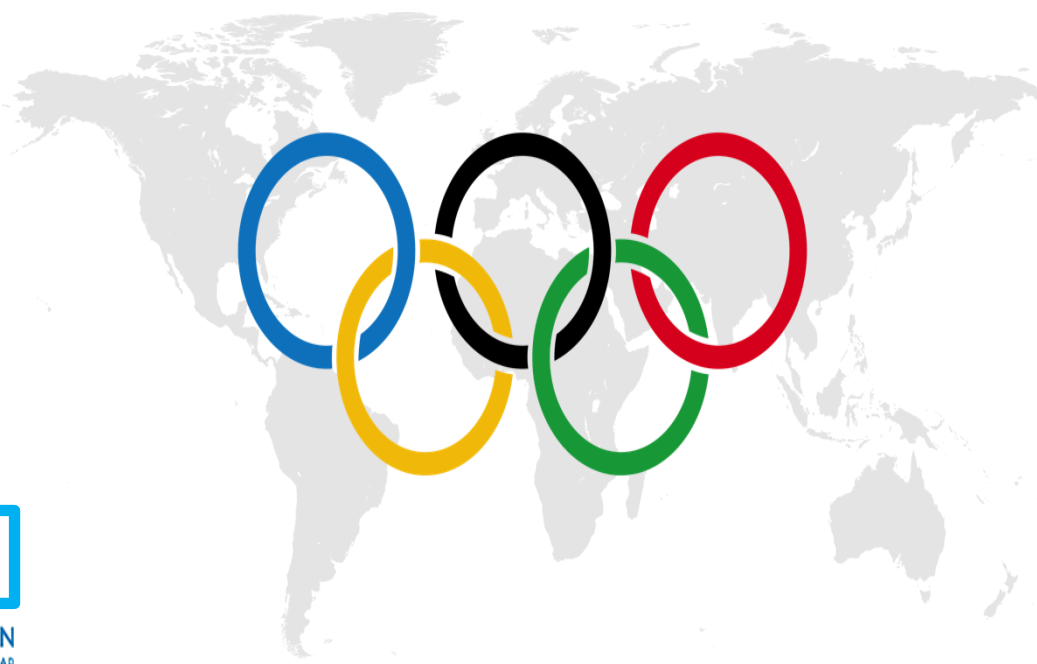
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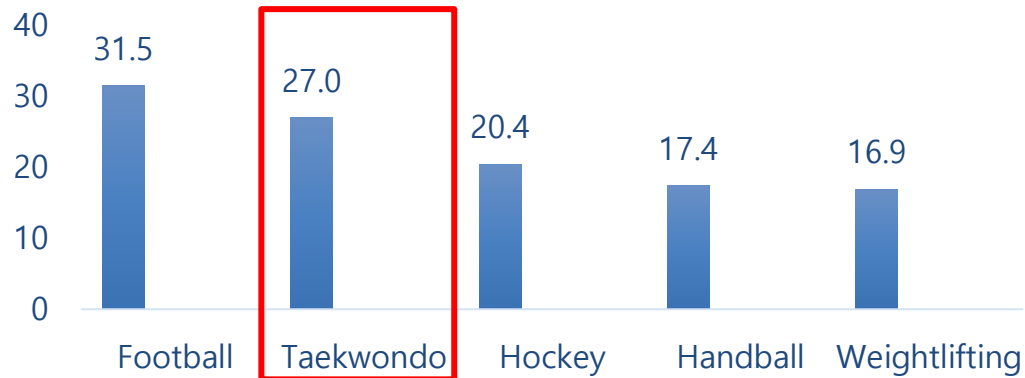


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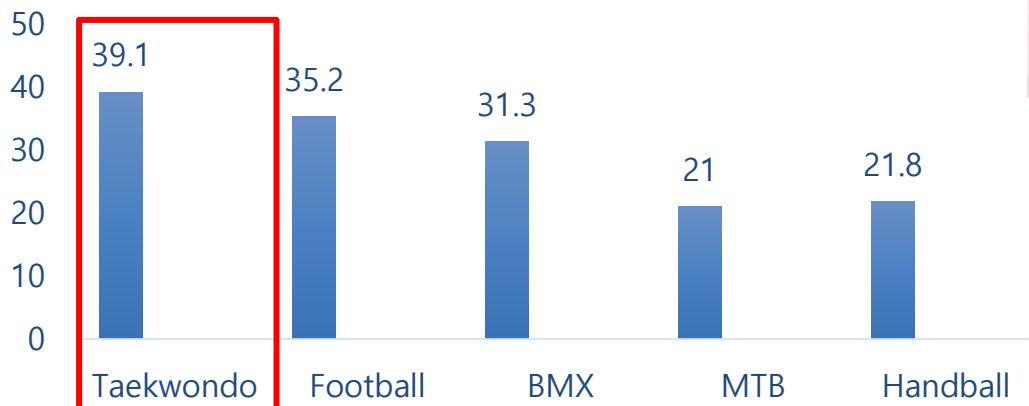
# Injury Prevention Strategy

Injury rate of taekwondo was higher next to football in Beijing summer Olympic games 2008, was highest in London summer Olympic games 2012

Rate of overall injuries in the 2008 Olympic sports(%)



Rate of overall injuries in the 2012 Olympic sports(%)



## Injury Prevention Strategy







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# Rules

## Rule Changes & Possible Effects

연도	올림픽개최지	점수제	규칙	장비	경기장 규격	경기 흐름 변화 및 손상 예측
2000	시드니	몸통, 머리 모두 1점		일반 호구 일반 헤드기어 (헤드기어와 호구를 도입한 뒤 시드니 올림픽에 채택될 수 있었다는 정보는 있으나 언제 헤드기어를 도입했는지는 자료를 찾을 수 없었습니다.)		몸통과 머리 점수가 같기 때문에, 몸통 위주 공격과 다소 소극적인 경기운영, 점수를 내고 도망다니는 전략 등
2004	아테네	몸통 1점 얼굴 2점 상대방 다운 시 1점 추가		일반 호구 일반 헤드기어	12*12m 사각형	머리 공격의 빈도 상승으로 인해 뇌진탕의 발생률이 높아짐 여전히 소극적인 경기운영 문제
2008	베이징	몸통 1점 얼굴 2점 상대방 다운 시 1점 추가	서든데스 도입*	일반 호구 일반 헤드기어 손등발등보호대 의무화 마우스 피스 의무화	10*10m 사각형	경기장 규모 축소로 공격 빈도 증가 아테네 올림픽 때의 룰과 비슷함으로 큰 변화는 없을 것으로 보임 마우스피스 착용으로 치아 손상 감소 예상
2012	런던	몸통 1점 회전 몸통 2점 머리 3점 회전 머리 4점 상대방 다운 시 1점 추가	비디오 판독 시스템 도입 10초를*	전자호구 손등, 발등보호대 (전자) 일반 헤드기어	8*8m 사각형	전자호구 위주 경기전략 변화 몸통 돌려차기보다 밀어차기, 커트발 (발을 들고 있는 동작) 하지만 이 때는 도입 초기이기 때문에 베이징올림픽 때와 비슷할 것으로 보임 얼굴 공격 빈도 증가
2016	리오	머리 3점 회전 머리 점수 4점 몸통 1점 회전 몸통 3점 상대방 다운 시 1점 추가	상대의 공격을 방해할 목적으로 3초 이상 다리를 들고 있는 행위->경고	전자호구 도입 전자헤드기어 도입	8*8m 팔각형	전자호구 완벽 적용 전자헤드기어를 사용하였기 때문에 타격보다 변칙기술이 많음 회전 기술이 점수가 추가되었지만, 전체적인 파워 감소로 오히려 뇌진탕의 빈도가 감소할 것으로 보임



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# Injury Surveillance System

# Injury Surveillance system

- [wtfiss.com](http://wtfiss.com)
  - Injury surveillance system for WTF
- [kociss.com](http://kociss.com)
  - Injury surveillance system for KOC
- [iociss.com](http://iociss.com)
  - Injury surveillance system for YISSEM



## World Taekwondo Injury and Illness Surveillance System

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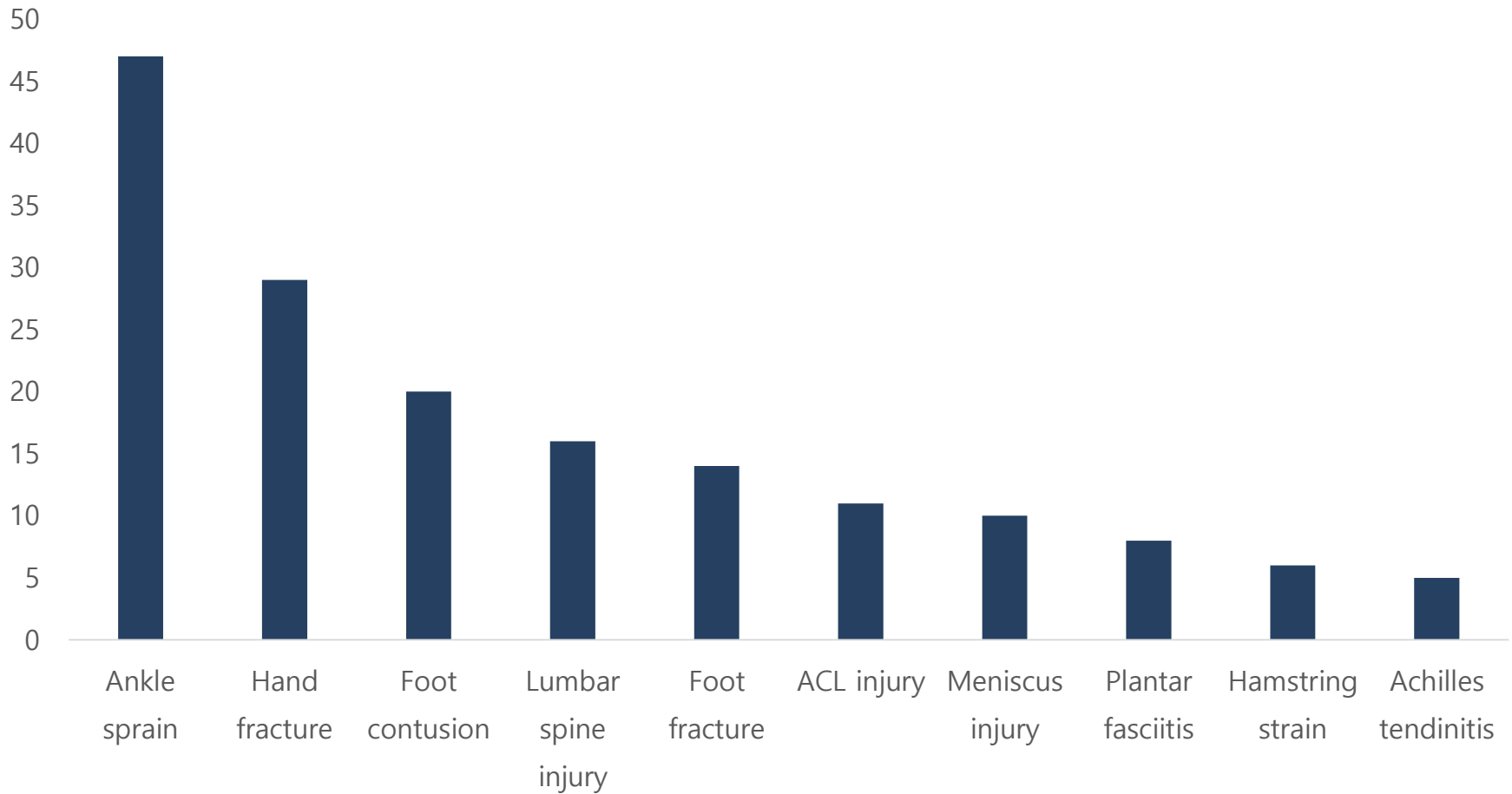
## Injury Surveillance system (2015~2016)

	Youth (n=183)	Adults (n=102)	Overall (n=285)
Age (years)	15.34±1.67	20.0±1.1	17.0±2.7
Gender (male/female)	116/67	65/27	180/92
Height (cm)	166.89±9.19	176.0±7.2	170.1±9.6
Weight (kg)	56.10±12.08	68.1±10.6	60.3±12.9
BMI (kg·m <sup>-2</sup> )	19.91±2.91	21.9±2.4	20.6±2.9
Experience (years)	3.04±2.30	8.0±2.7	4.8±3.4

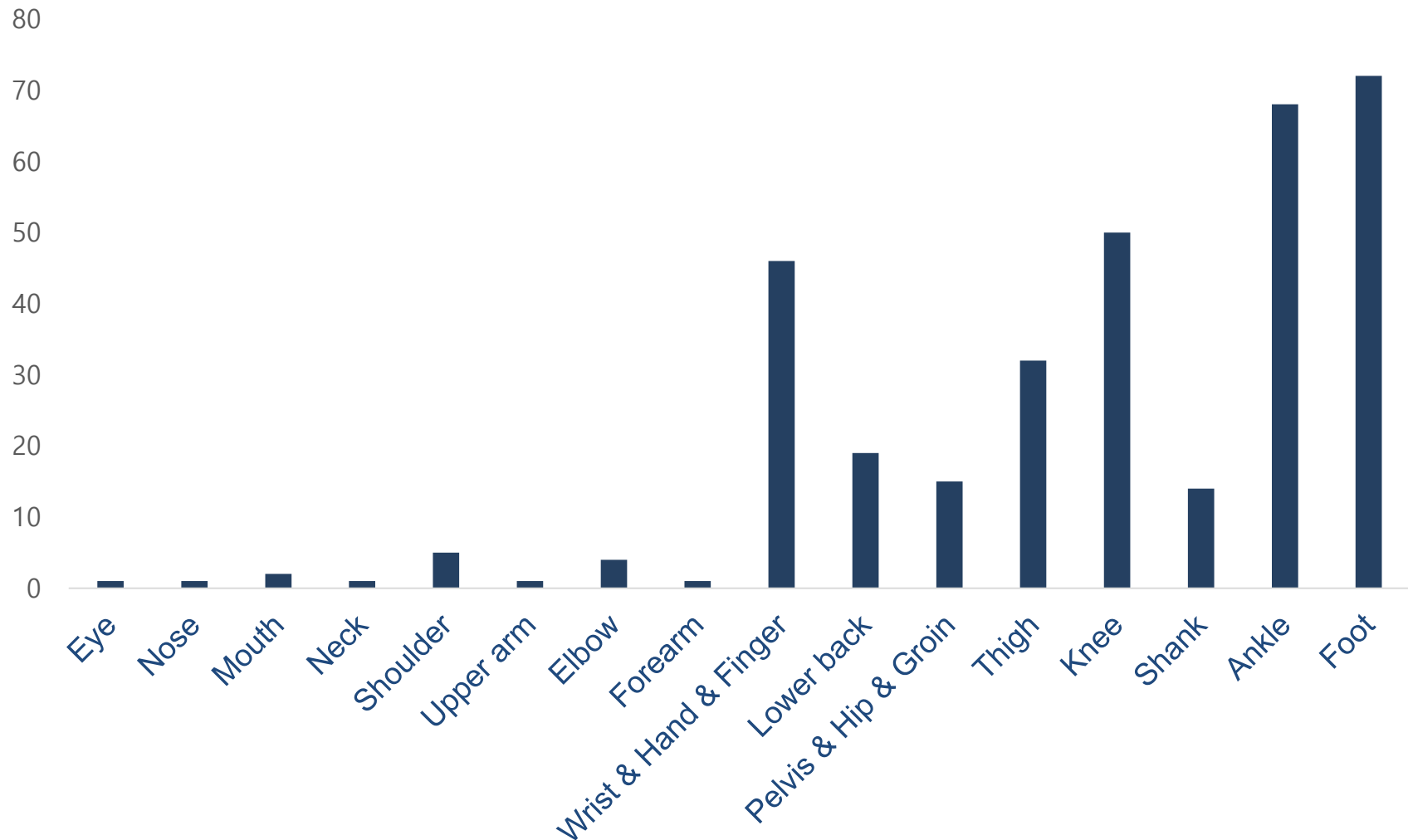
# Injury Surveillance system

Category	Practice			Game			Overall
	IIR (95% CI)	RR (95% CI)	OR (95% CI)	IIR (95% CI)	RR (95%CI)	OR (95% CI)	OR (95% CI)
Overall	4.79 (2.3 to 7.27)	Ref.	N/A	26.70 (21.56 to 31.84)	5.57 (2.91 to 8.23)	N/A	N/A
Youth	4.72 (1.65 to 7.79)	0.94 (0.63 to 1.40)	1.75 (1.08 to 2.83)	27.00 (20.57 to 33.43)	1.32 (0.04 to 1.21)	2.18 (1.19 to 4.00)	1.82 (1.15 to 2.89)
Adult	5.02 (0.76 to 9.28)	Ref.	Ref.	20.40 (12.58 to 28.22)	Ref.	Ref.	Ref.
Male	N/A	N/A	1.83 (1.10 to 3.02)	N/A	N/A	0.97 (0.63 to 1.50)	0.64 (0.39 to 1.03)
Female	N/A	N/A	Ref.	N/A	N/A	Ref.	Ref.

# Injury Surveillance system (Top 10 Injury)

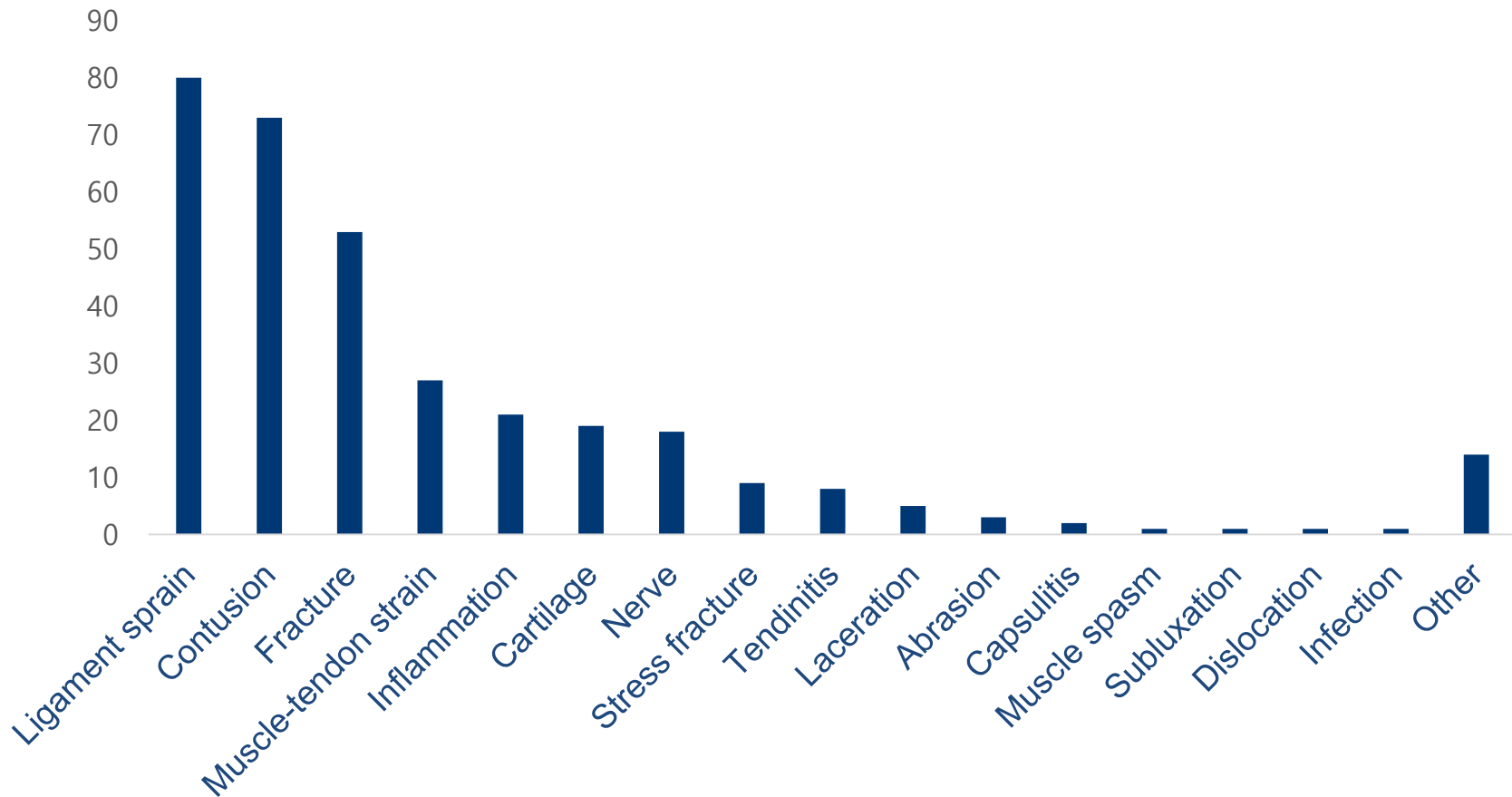


# Injury Surveillance system (Body Part)





# Injury Surveillance system (Type)

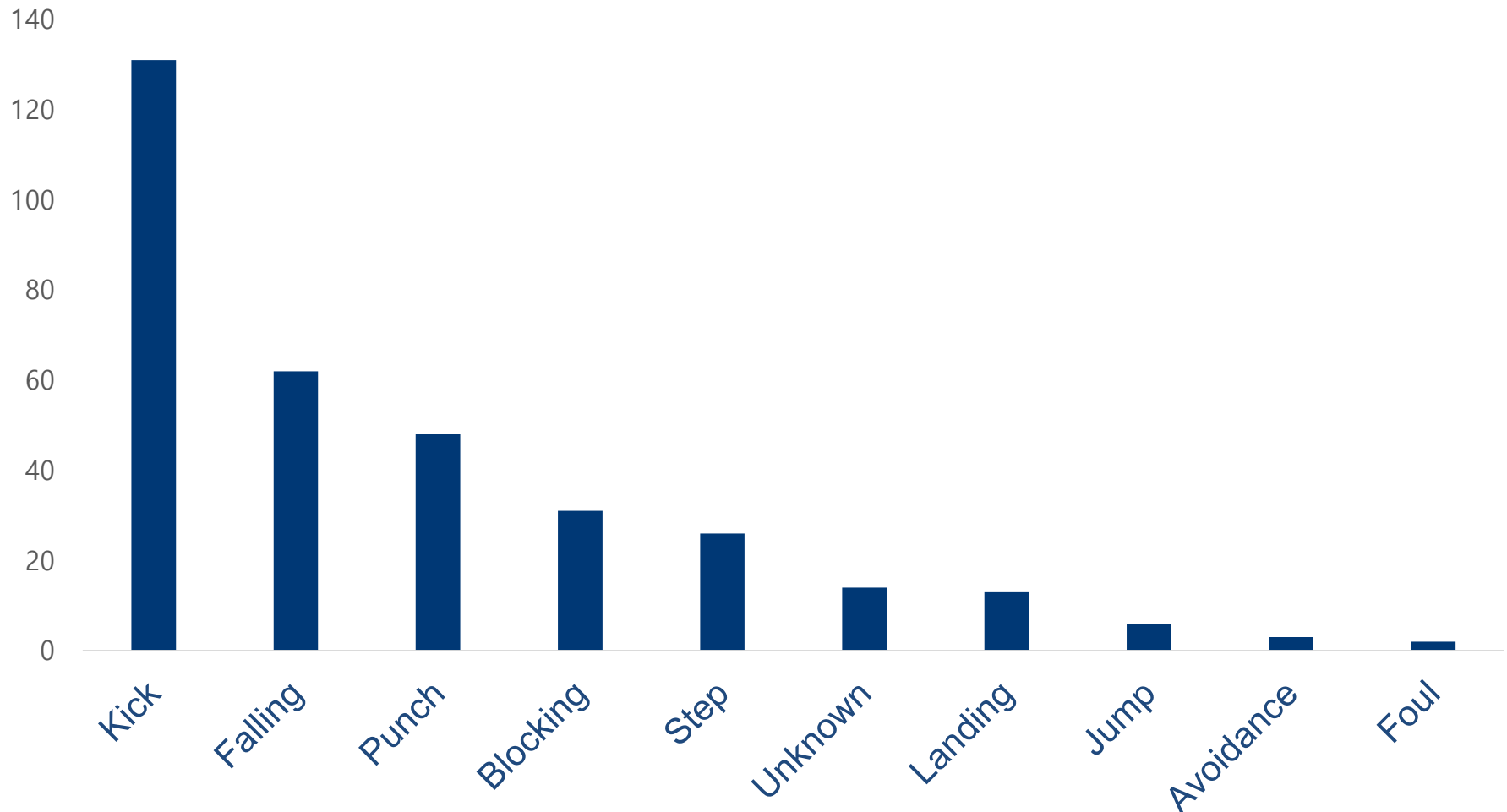




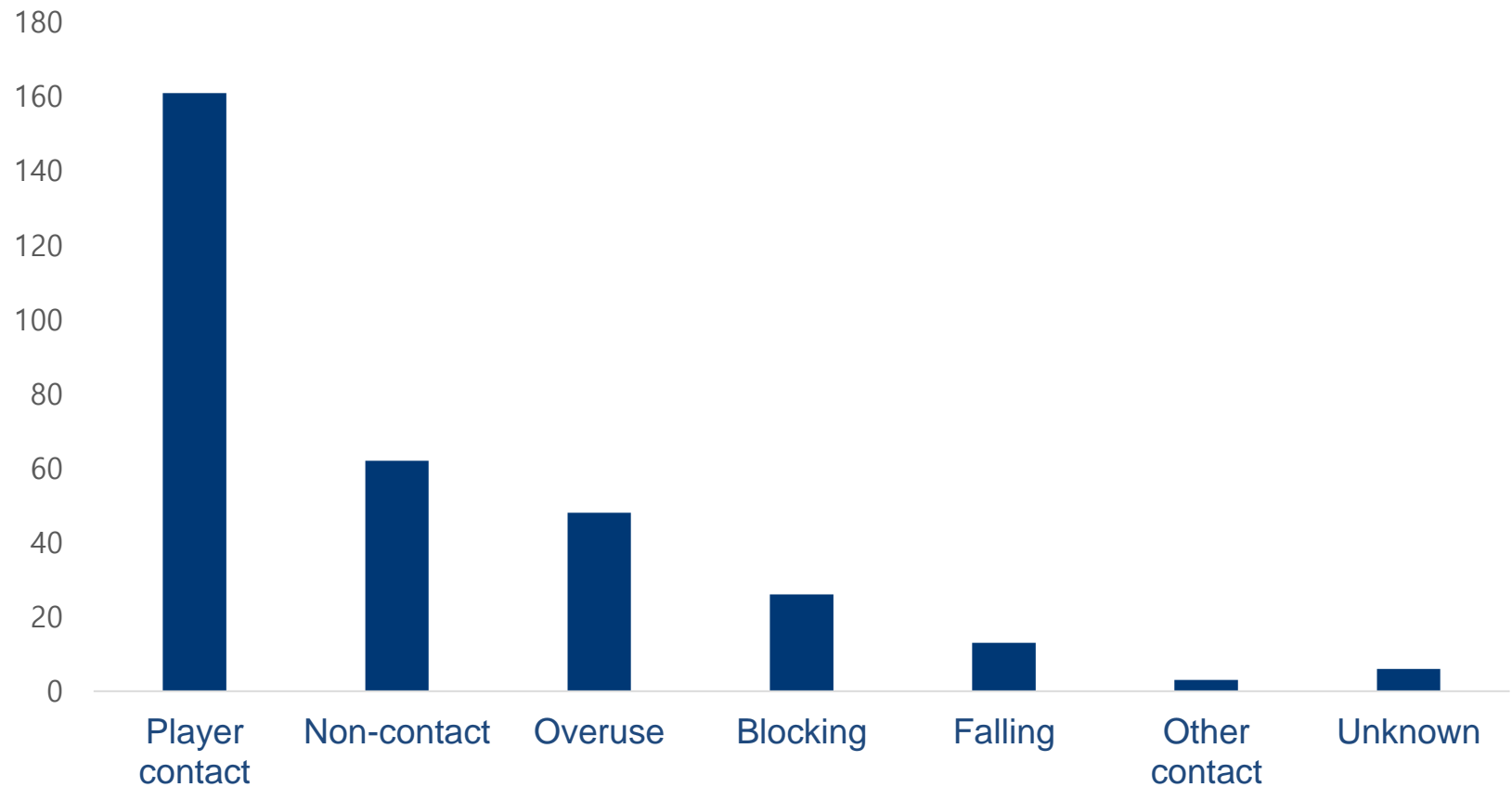
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# Video Analysis

# Injury Surveillance system (Activity)



# Injury Surveillance system (Activity)



## Video Analysis

- Head concussion injury
  - Koh & Voaklander, 2016; Koh et al, 2004; Koh & Watkinson, 2002
- Other sports injuries should be analyzed to establish better injury prevention strategy
- Analysis of both epidemiological data and video analysis is current trends in injury prevention study.

### ORIGINAL RESEARCH

#### Effects of Competition Rule Changes on the Incidence of Head Kicks and Possible Concussions in Taekwondo

Koh Jae-Ok, PhD\* and Don Voaklander, PhD†

**Objective:** Competition rules related to head kicks (HKs) in sparring-taekwondo (S-TKD) were changed in 2009, resulting in more points awarded to the head attacker. The objective of this research is to measure the incidence of HKs and to analyze the characteristics of situations leading up to and after HKs in a postrule change competition.

**Design:** Descriptive epidemiology study using video analysis.

**Setting:** The final matches of the World Taekwondo Championships (WTCs) in 2011 and 2013.

**Participants:** A total of 1760 athletes participated in both WTCs. Sixty-four athletes, who had won elimination-round matches and were 15 years or older, competed in final matches.

**Main Outcome Measures:** The final matches—a total of 64 matches including 95 rounds—were analyzed using an anatomical and outcome coding scheme for HKs.

**Results:** Overall, a total of 30 athletes experienced receiving one or more HKs during 2 WTCs (469 HKs per 1000 athlete-exposures (A-E), 95% confidence interval = 296, 642). Female athletes showed higher incidences of HKs than male. A trend of increasing incidence of HKs was observed in the females. The HKs occurred more frequently among competitors in lightweight categories and those of similar height (49%).

**Conclusions:** Overall, the frequency of HKs seems to have increased compared with matches before 2009. A sharp increase in the numbers of HKs is evident among the elite female athletes. To prevent receiving an HK, updated game strategies such as training for blocking skills, and safety guidelines for HKs, or revisions to rules are needed.

**Clinical Relevance:** The recent changes to competition rules promoting the use of HKs may have resulted in an increasing frequency of HKs compared with research findings before these changes. Multiple HKs occur frequently in S-TKD; care needs to be taken to avoid possible acute/chronic consequences.

**Key Words:** taekwondo, concussion, head injury, rule change

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#### INTRODUCTION

Taekwondo is a martial art that is divided into 3 forms: sparring-taekwondo (S-TKD or Olympic style taekwondo), *poomsae* (or sport-poomsae, which is noncontact by virtue of following a structured pattern), and object-breaking maneuvers (an object contact sport). Among these types, S-TKD is a full-contact sport that permits the delivery of all types of kicking techniques to legal scoring areas including the head/face and torso.

Competition rule changes have been made by the World Taekwondo Federation (WTF) several times in the last decade to improve the technical quality of S-TKD and to provide fairer judging and more interesting displays for spectators. In particular, the rule amendment on a valid kick to the head/face has changed dramatically. Three or 4 points were awarded for such kicks beginning in 2009 (vs 1 or 2 points before). A further change was made in 2011 regarding the criteria for a valid head kick (HK); the definition of such kicks was extended to include a simple light touching of the head/face region (whereas an HK needed to generate contact force to score points in before 2011).

Depending on the type of kicking skills, the head linear acceleration and potential head injury threshold ranged from 18 to 73 gravitational forces (g) and from 22 to 677g, respectively. The values for the jump back, jump hook, and turning kicks surpassed the head injury potential value related to punches delivered in boxing (ie, head linear acceleration = 67g and head injury threshold = 167). In addition, linear accelerations for the clenched axe kick of taekwondo exceed the uppercut in boxing (33g vs 24g, respectively).<sup>1</sup> As a result of the significant impact of taekwondo kicks and the rule allowing head contact, the incidence of concussion in men participating in S-TKD has been estimated as 4 times higher over 15 years than in American gridiron football over a 16-year period.<sup>2,3</sup>

Although recent competition rule amendments may encourage athletes to execute more HKs,<sup>1,3</sup> there seems to have been minimal concern with the effects of these changes on athletes' health. This is unfortunate, especially given the growing concern with sports-related subconcussive impacts and concussion and the negative short- and long-term effects,<sup>4–8</sup> although data on a cause and effect relationship for these effects is limited.<sup>9–11</sup> To date, however, there is limited research available focusing on the elite level of S-TKD. The purpose of this study is (a) to measure the incidence of head blows and (b) to analyze characteristics of situations leading up to and following head blows during final matches of 2 consecutive WTCs from 2011 to 2013.

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# Prevention Strategy

# Injury Prevention Strategy



## Injury Prevention Strategy

### FIFA 11+

#### PART 1 RUNNING EXERCISES - 8 MINUTES

<p><b>1 RUNNING STRAIGHT AHEAD</b></p> <p>Run forward in a straight line for 10 seconds. Repeat 10 times. This exercise is designed to improve your running technique and to warm up your muscles. It is a good exercise to do before a game.</p>	<p><b>2 RUNNING HIP OUT</b></p> <p>Run forward in a straight line for 10 seconds. Repeat 10 times. This exercise is designed to improve your running technique and to warm up your muscles. It is a good exercise to do before a game.</p>	<p><b>3 RUNNING HIP IN</b></p> <p>Run forward in a straight line for 10 seconds. Repeat 10 times. This exercise is designed to improve your running technique and to warm up your muscles. It is a good exercise to do before a game.</p>
<p><b>4 RUNNING CIRCLING PARTNER</b></p> <p>Run in a circle around your partner for 10 seconds. Repeat 10 times. This exercise is designed to improve your running technique and to warm up your muscles. It is a good exercise to do before a game.</p>	<p><b>5 RUNNING SHOULDER CONTACT</b></p> <p>Run forward in a straight line for 10 seconds. Repeat 10 times. This exercise is designed to improve your running technique and to warm up your muscles. It is a good exercise to do before a game.</p>	<p><b>6 RUNNING QUICK FORWARDS &amp; BACKWARDS</b></p> <p>Run forward in a straight line for 10 seconds. Repeat 10 times. This exercise is designed to improve your running technique and to warm up your muscles. It is a good exercise to do before a game.</p>

#### PART 2 STRENGTH · PLYOMETRICS · BALANCE · 10 MINUTES

LEVEL 1	LEVEL 2	LEVEL 3
<p><b>7 THE BENCH STATIC</b></p> <p>Stand on a bench with your feet shoulder-width apart. Hold the position for 30 seconds. Repeat 10 times. This exercise is designed to improve your balance and to warm up your muscles. It is a good exercise to do before a game.</p>	<p><b>8 THE BENCH ALTERNATE LEGS</b></p> <p>Stand on a bench with your feet shoulder-width apart. Alternate legs for 30 seconds. Repeat 10 times. This exercise is designed to improve your balance and to warm up your muscles. It is a good exercise to do before a game.</p>	<p><b>9 THE BENCH ONE LEG LIFT AND HOLD</b></p> <p>Stand on a bench with your feet shoulder-width apart. Lift one leg and hold for 30 seconds. Repeat 10 times. This exercise is designed to improve your balance and to warm up your muscles. It is a good exercise to do before a game.</p>
<p><b>10 SIDEWAYS BENCH</b></p> <p>Stand on a bench with your feet shoulder-width apart. Hold the position for 30 seconds. Repeat 10 times. This exercise is designed to improve your balance and to warm up your muscles. It is a good exercise to do before a game.</p>	<p><b>11 SIDEWAYS BENCH RAISE &amp; LOWER HIP</b></p> <p>Stand on a bench with your feet shoulder-width apart. Raise and lower your hip for 30 seconds. Repeat 10 times. This exercise is designed to improve your balance and to warm up your muscles. It is a good exercise to do before a game.</p>	<p><b>12 SIDEWAYS BENCH WITH LEG LIFT</b></p> <p>Stand on a bench with your feet shoulder-width apart. Lift one leg and hold for 30 seconds. Repeat 10 times. This exercise is designed to improve your balance and to warm up your muscles. It is a good exercise to do before a game.</p>
<p><b>13 HAMSTRINGS BEGINNER</b></p> <p>Stand on a bench with your feet shoulder-width apart. Hold the position for 30 seconds. Repeat 10 times. This exercise is designed to improve your balance and to warm up your muscles. It is a good exercise to do before a game.</p>	<p><b>14 HAMSTRINGS INTERMEDIATE</b></p> <p>Stand on a bench with your feet shoulder-width apart. Hold the position for 30 seconds. Repeat 10 times. This exercise is designed to improve your balance and to warm up your muscles. It is a good exercise to do before a game.</p>	<p><b>15 HAMSTRINGS ADVANCED</b></p> <p>Stand on a bench with your feet shoulder-width apart. Hold the position for 30 seconds. Repeat 10 times. This exercise is designed to improve your balance and to warm up your muscles. It is a good exercise to do before a game.</p>
<p><b>16 SINGLE-LEG STANCE HOLD THE BALL</b></p> <p>Stand on one leg with a ball in your hand. Hold the position for 30 seconds. Repeat 10 times. This exercise is designed to improve your balance and to warm up your muscles. It is a good exercise to do before a game.</p>	<p><b>17 SINGLE-LEG STANCE THROWING BALL WITH PARTNER</b></p> <p>Stand on one leg with a ball in your hand. Throw the ball to your partner. Repeat 10 times. This exercise is designed to improve your balance and to warm up your muscles. It is a good exercise to do before a game.</p>	<p><b>18 SINGLE-LEG STANCE TEST YOUR PARTNER</b></p> <p>Stand on one leg with a ball in your hand. Test your partner's balance. Repeat 10 times. This exercise is designed to improve your balance and to warm up your muscles. It is a good exercise to do before a game.</p>
<p><b>19 SQUATS WITH TOE RAISE</b></p> <p>Squat with your feet shoulder-width apart. Raise your toes. Repeat 10 times. This exercise is designed to improve your balance and to warm up your muscles. It is a good exercise to do before a game.</p>	<p><b>20 SQUATS WALKING LUNGES</b></p> <p>Squat with your feet shoulder-width apart. Walk forward. Repeat 10 times. This exercise is designed to improve your balance and to warm up your muscles. It is a good exercise to do before a game.</p>	<p><b>21 SQUATS ONE-LEG SQUAT</b></p> <p>Squat with one leg. Repeat 10 times. This exercise is designed to improve your balance and to warm up your muscles. It is a good exercise to do before a game.</p>
<p><b>22 JUMPING VERTICAL JUMPS</b></p> <p>Jump vertically. Repeat 10 times. This exercise is designed to improve your balance and to warm up your muscles. It is a good exercise to do before a game.</p>	<p><b>23 JUMPING LATERAL JUMPS</b></p> <p>Jump laterally. Repeat 10 times. This exercise is designed to improve your balance and to warm up your muscles. It is a good exercise to do before a game.</p>	<p><b>24 JUMPING BOX JUMPS</b></p> <p>Jump onto a box. Repeat 10 times. This exercise is designed to improve your balance and to warm up your muscles. It is a good exercise to do before a game.</p>

## THE "11+"

A complete warm-up programme to prevent injuries

# MANUAL





## Injury Prevention Strategy



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Boxing



Canoeing



Cycling



Diving



Equestrian



Fencing



# Injury Prevention Strategy

Why Not  
WTF???

Why?  
N.t

Why  
Not?

WHY NOT

why n? t

WHY  
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NOT.

# Injury Prevention Strategy

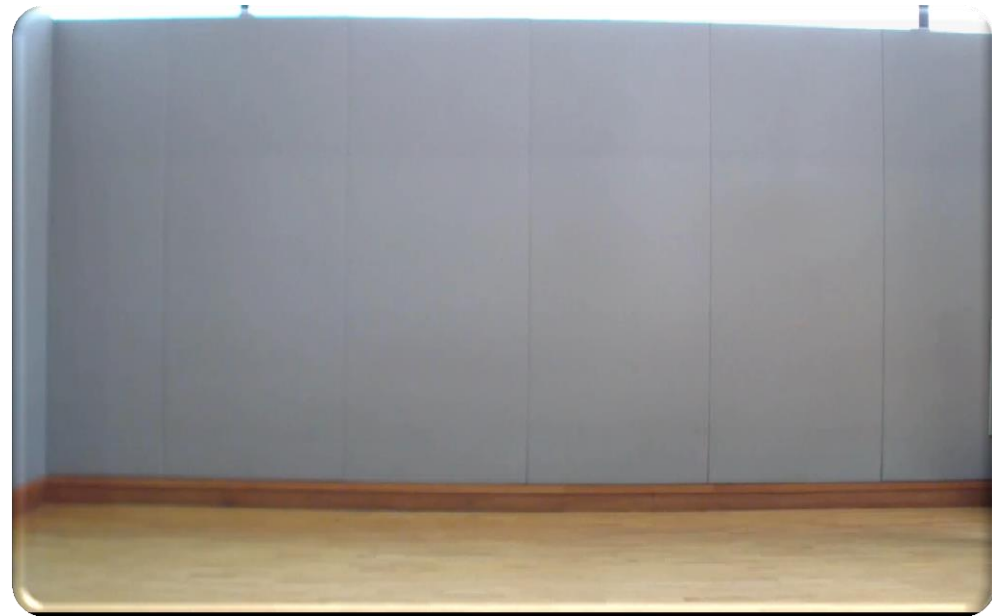
Hamstring, ankle, & knee prevention  
warm-up exercise

# Prevent Ankle Injuries (warm- up)

## Prevention for Ankle Injury

### Strength & Balance

- Keep your knee completely straight  
무릎을 최대한 펴준다.
  - Walk on toes(Lift as high as you can)  
발끝으로만 걷는다.(할 수 있는 만큼 최대한 높이)
  - 20-30s  
20-30초 유지
- 
- Swing leg  
다리를 흔든다.
  - Cross in front and behind the standing leg  
땅에서 떴 발을 지탱하는 발의 앞, 뒤로 가로지른다.
  - 3 X 10-15s on each leg  
각 다리 당 10-15초씩 3세트 실시



## Prevention for Ankle Injury

### Strength & Balance

- Keep your knee completely straight  
무릎을 최대한 펴준다.
  - 15 slow calf raises  
뒤꿈치 들기를 천천히 15번 실시
- 
- Bounce ball  
공을 튀기며
  - 3 X 10-15s on each leg  
각 다리 당 10-15초씩 3세트 실시



## Prevention for Ankle Injury

### Single Leg Balance with Resistance

- Keep your knee completely straight  
무릎을 최대한 펴준다.
- Vary the resistance to challenge yourself  
스스로 저항의 강도를 다양하게 실시
- Cross in front and behind the standing leg  
땅에서 떴 발을 지탱하는 발의 앞, 뒤로 가로지른다.
- 3 X 10-15s on each leg  
각 다리 당 10-15초씩 3세트 실시





# Prevent Knee Injuries



## Prevention for **K**nee Injury

### Cut & Plant

- Keep knee over toe  
무릎이 발끝을 넘지 않도록 한다.
- 5-7 cuts on each side  
각 방향마다 5-7회의 방향전환을 실시한다.



## Prevention for **Knee Injury**

### Single Leg Jumping

- 2 Hops on the right, cross over, 2 hops on left  
2번의 호핑 후 반대로 건너뛰어 2번 호핑 실시.
- Finish with 2 feet landing  
마무리 동작은 양 발로 착지한다.
- Always keep knee over toe  
언제나 무릎은 발끝을 넘기지 않도록 한다.
- 5-10 reps  
5-10회 실시.



## Prevention for **K**nee Injury

### Jump & Push

- Push partner while he/she is jumping  
선수가 점프를 할 때 파트너가 밀쳐낸다.
- Unpredictable direction of push  
예측 불가능한 방향으로 민다.
- Soft landings on 2 feet  
양 발로 안전하게 착지
- Always keep knees over toes  
언제나 무릎은 발끝을 넘지 않도록 한다.
- 2 X 20-30s  
20-30초씩 2세트 실시





# Prevent Hamstrings Injuries

## Prevention for Hamstrings Injury

### Nordic Hamstrings

- The athlete stands kneeling on the Balance-pad and the assistant holds the ankle in the back and fixes it.  
선수는 Balance 패드 위에 무릎을 꿇은 채로 서고, 보조자는 뒤에서 발목을 잡아 고정시킨다.
- Straight body from shoulder to knee  
어깨부터 무릎까지 수직으로 선다.
- Keep body rigid  
몸을 꼳꼳이 유지한다.
- Fall forward slowly  
천천히 정면으로 몸을 기울이며 떨어진다.
- Push back with arms  
바닥에 닿으면 팔로 밀어내 시작 위치로 온다.
- 2 X 3-5reps  
3-5회씩 2세트 실시



## Prevention for Hamstrings Injury

### Knee extension

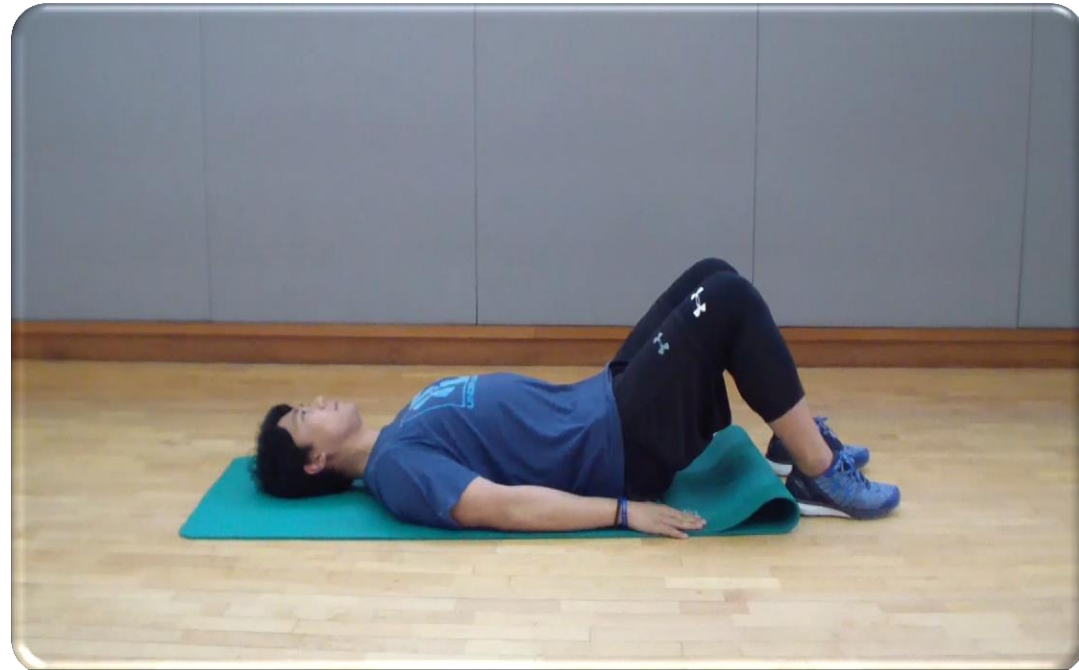
- Stabilize thigh  
하늘을 보고 누운 채로 다리를 들어올려 허벅지를 양손으로 잡아 고정시킨다.
- Straighten and bend knee slowly  
무릎을 천천히 구부렸다 폈다 실시한다.
- Relax ankle  
발목의 긴장은 푼다.(종아리의 스트레칭을 위해서는 발목을 당겨준다.)
- Increase speed gradually  
단계적으로 속도를 올린다.
- 3 X 5 reps each leg  
각 다리당 5회씩 3세트 실시



## Prevention for Hamstrings Injury

### Double Leg Bridge

- Push through heel to raise hips  
반듯이 누운 채로 뒤꿈치로 밀어 엉덩이를 들어올린다.
- Stop when body is straight from shoulder to knee  
어깨와 무릎이 일직선이 되는 곳에서 멈춘다.
- 3 X 15reps  
15회씩 3세트 실시



# Injury Prevention Strategy







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**Thank You!!!!!!**