Physical Fitness & Health
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Department of Orthopaedics & Traumatology,
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Overview

Exercise is Good for Health

Exercise is Bad for Health
Overview

Exercise is Good for Health

Exercise is Bad for Health

What are the Common injuries

How to prevent them
HA Mission

Sports for Health

Vision
- Healthy People, Happy Staff, Trusted by the Community

Mission
- Helping People Stay Healthy

Values
- People-centred Care
- Professional Service
- Committed Staff
- Teamwork

AADOC / HKSSH Conjoint Scientific Meeting 2011
AADO / HKSSH Conjoint Scientific Meeting 2011

Queen Elizabeth Hospital, Hong Kong
Exercise = Health?

• Regular exercise brings about physical and mental fitness
• The best way?
• The only way?
• For all ages?
Exercise=Health??

surviving former male athletes who represented Finland between the years 1920 and 1965

Life expectancy: (n=2613)
- endurance athletes (Dist. Run”, XC Ski”, etc) 75.6
- team sports athletes (IH/FB/BB/TF) 73.9
- Control 69.9 (n=1712)
- Sarna 1993, MSSE, Dept. of Public Health, Helsinki U
Exercise=Health????
You live longer !!!!!

Finland Study
Life expectancy:
- 5.5 years longer for endurance athletes
- 4.0 years longer for team sports athletes
- Lower prevalence of diabetes and CVD
- Sarna et al, MSSE 1993
Prevalence of diabetes, hypertension, and ischemic heart disease in former elite athletes

- Kujala et al
- surviving former male athletes who represented Finland between the years 1920 and 1965
- athletes, n = 1,282; referents n = 777
- former endurance athletes had the lowest ORs for diabetes (OR 0.24; 95% confidence interval, 0.07 to 0.81) and ischemic heart disease (OR 0.33; 0.18 to 0.61).
- power-sports athletes had a higher risk for high body mass index (BMI) but a lower risk for ischemic heart disease.
Exercise=Health???


2049 nat’l team athletes (1920-1965)
1403 healthy controls
hospitalizations 1970-1990
risk adjusted for age and profession

Relative risk for hospitalization

Control  Endurance  Mixed  Power

0.0  0.1  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1.0
Exercise = Health????


2049 nat’l team athletes (1920-1965)
1403 healthy controls
hospitalizations 1970-1990
risk adjusted for age and profession

Relative risk for hospitalization - heart disease

- Control
- Endurance
- Mixed
- Power
Exercise=Health????


2049 nat’l team athletes (1920-1989)
1403 healthy controls
hospitalizations 1970-1989
risk adjusted for age and profession

Relative risk for hospitalization - respiratory disease

Control | Endurance | Mixed | Power
Exercise = Health???


2049 nat’l team athletes (1920-1965)
1403 healthy controls
hospitalizations 1970-1990
risk adjusted for age and profession

Relative risk for hospitalization-neoplasms

Control  Endurance  Mixed  Power

[Bar chart showing relative risk for hospitalization-neoplasms for different groups: Control, Endurance, Mixed, and Power.]
Do the health benefits of regular exercise outweigh the risk of injury and long-term disability, especially in high level athletes?

Osteoarthritis of weight bearing joints of lower limbs in former élite male athletes

- Athletes from all types of competitive sports are at slightly increased risk of requiring hospital care because of osteoarthritis of the hip, knee, or ankle. Mixed sports and power sports lead to increased admissions for premature osteoarthritis, but in endurance athletes the admissions are at an older age.
Exercise is Bad ?!

High prevalence of osteoarthritis 14 years after an anterior cruciate ligament tear in male soccer players: a study of radiographic and patient relevant outcomes

- Von Porat, Roos & Roos
- Ann Rheum Dis 2004;63:269
ACL & OA

• The incidence of OA in female competitive athletes was **82%** 12 years after injury.
• No difference was found in OA between patients who were treated conservatively or surgically.
Musculoskeletal Functions enhanced by exercise

- Metabolic capacity & nutrient blood supply
  - Increases stamina
  - Ameliorates effects of aging
- Strength & Contractility
  - Improves endurance & balance
  - Reduces risk of injury
Optimal Level of Exercise
Exercise Prescription

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本網站與運動處方計劃同步推出。運動處方計劃是一個健康推廣計劃，目的是透過政府、醫生、從事促進運動的機構及社區團體的通力合作，向大眾推廣體能活動。

全球每年有多達二百萬人因缺乏運動而死亡，令推廣體能活動成爲一項重要的公共健康舉措。醫護人員在鼓勵其服務使用者進行體能活動上，扮演著舉足輕重的角色，而向病者按其需要處方適切的運動建議，並提供一份個人化及可供細閱的運動處方概念，早於澳洲、美國及英國等地的醫護界別中試行及取得良好效果。香港衞生署亦於二零零三年在本港進行了一項隨機對照試驗，以評估將這個概念融入治療過程的成效，試驗結果也顯示，病人進行體能活動的動機有顯著改善。
The Golden Rules

- The mnemonic "EASIER" symbolizes the 6 golden rules on writing a prescription
  - Effectiveness,
  - Accessibility,
  - Safety,
  - Individualization,
  - Enjoyment,
  - Regular evaluation.
Sports injuries are a significant concern — for the injured athlete, for sports organizations, and for society.
Relative Neglect: Cinderella Disease

- Rarely life threatening
- Quality of Life
- Long term effects

- Economic active
- Daily function
- Livelihood
Epidemiology Data

- 7 Million athletic injuries annually in the US
- 3.7 Million ER Visits (11% of all injury related ER Visits)
- Majority (68%): young & healthy (5-24)
- Average cost of care: US $17,000 per patient
  - potential loss of entire seasons,
  - loss of scholarship funding,
  - ensuing effects on the athlete’s mental health,
  - academic performance

- 25.9 injury episodes per 1000 population
- 1.1 million injuries involve the head or neck region, of which 17% were internal head injuries.
- The most common mechanisms of injury were struck by/against (34%), fall (28%), and overexertion (13%).
- National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia, USA.
Annual Statistics

- 6.2% of the population (or 415,200 persons) reported to sustain at least one unintentional injury that was serious enough to limit their normal activities.
- 20.8% (or 95,500) of them took place when the injured persons were engaged in sports-related activity.

Surveillance and Epidemiology Branch
Centre for Health Protection
Incidence

- Among the 6.74 million population, 1.3% of them sustained sports-related injury episodes in the 12 months before survey.
- Higher for males (1.9%) than for females (0.7%).
- Higher for persons aged 0 to 64 (1.4%) than elderly persons aged 65 and above (0.4%).
Activity Level

- Incidence increased consistently with their level of physical activity:
  - low level of physical activity: 0.4%
  - moderate level of physical activity: 1.1%
  - high level of physical activity: 1.7%

<table>
<thead>
<tr>
<th>Whether sustained sports-related injury episodes</th>
<th>Level of physical activity</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>No. of persons (‘000)</td>
<td>%</td>
</tr>
<tr>
<td>Yes</td>
<td>2.7</td>
<td>0.4</td>
</tr>
<tr>
<td>No</td>
<td>681.0</td>
<td>99.6</td>
</tr>
<tr>
<td>Total</td>
<td>683.7</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Base: Respondents aged 15 and above
## Type of Sports

<table>
<thead>
<tr>
<th>Type of sport / exercise activity associated with sports-related injury episodes</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No. of episodes ('000)</strong></td>
<td><strong>%</strong></td>
<td><strong>No. of episodes ('000)</strong></td>
<td><strong>%</strong></td>
</tr>
<tr>
<td>Team ball sports</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soccer</td>
<td>25.6</td>
<td>37.5</td>
<td>*</td>
</tr>
<tr>
<td>Basketball</td>
<td>18.6</td>
<td>27.1</td>
<td>2.8</td>
</tr>
<tr>
<td>Hand ball</td>
<td>1.5</td>
<td>2.1</td>
<td>2.0</td>
</tr>
<tr>
<td>Volleyball</td>
<td>1.8</td>
<td>2.7</td>
<td>0.7</td>
</tr>
<tr>
<td>Racquet sports</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tennis</td>
<td>6.6</td>
<td>9.6</td>
<td>*</td>
</tr>
<tr>
<td>Badminton</td>
<td>2.7</td>
<td>3.9</td>
<td>2.6</td>
</tr>
<tr>
<td>Individual athletic activities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Track and field</td>
<td>0.5</td>
<td>0.8</td>
<td>2.5</td>
</tr>
<tr>
<td>Running</td>
<td>0.5</td>
<td>0.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Jogging</td>
<td>0.9</td>
<td>1.4</td>
<td>0.7</td>
</tr>
<tr>
<td>Yoga</td>
<td>*</td>
<td>*</td>
<td>0.7</td>
</tr>
<tr>
<td>Adventure sports – Hiking</td>
<td>2.5</td>
<td>3.7</td>
<td>2.3</td>
</tr>
<tr>
<td>Wheeled non-motored sports – Cycling</td>
<td>1.0</td>
<td>1.4</td>
<td>3.4</td>
</tr>
<tr>
<td>Individual water sports – Swimming</td>
<td>1.6</td>
<td>2.3</td>
<td>0.7</td>
</tr>
<tr>
<td>Other sport / exercise activities</td>
<td>4.7</td>
<td>6.9</td>
<td>6.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>68.4</td>
<td>100.0</td>
<td>27.1</td>
</tr>
</tbody>
</table>
Type of Sports

- 56%
- 12%
- 8%
- 5%
- 5%
- 2%
- 12%
- Others

Legend:
- TBG
- RAQ
- IAS
- AOS
- WNM
- IWS
- Others
<table>
<thead>
<tr>
<th>Place of occurrence of sports-related injury episodes</th>
<th>No. of episodes ('000)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sports or athletics area</td>
<td>60.4</td>
<td>63.3</td>
</tr>
<tr>
<td>School or educational area</td>
<td>17.6</td>
<td>18.5</td>
</tr>
<tr>
<td>Countryside</td>
<td>6.8</td>
<td>7.1</td>
</tr>
<tr>
<td>Recreational area, cultural area or public building</td>
<td>6.1</td>
<td>6.4</td>
</tr>
<tr>
<td>Other places of occurrence</td>
<td>4.6</td>
<td>4.8</td>
</tr>
<tr>
<td>Total</td>
<td>95.5</td>
<td>100.0</td>
</tr>
</tbody>
</table>

- more than three-fifths (63.3%) of these injury episodes took place at **sports or athletics area**. It was followed by school or educational area (18.5%), countryside (7.1%), and recreational area, cultural area or public building (6.4%)
### Direct Mechanism of Injury

<table>
<thead>
<tr>
<th>Major direct mechanism of sports-related injury episodes</th>
<th>No. of episodes (‘000)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical over-exertion – Acute over-exertion, over-extension</td>
<td>50.2</td>
<td>52.6</td>
</tr>
<tr>
<td>Blunt force</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact with object or animal</td>
<td>29.5</td>
<td>30.9</td>
</tr>
<tr>
<td>Contact with person</td>
<td>10.2</td>
<td>10.7</td>
</tr>
<tr>
<td>Crushing</td>
<td>2.6</td>
<td>2.7</td>
</tr>
<tr>
<td>Abrading, rubbing</td>
<td>1.8</td>
<td>1.9</td>
</tr>
<tr>
<td>Piercing / penetrating force – Scratching, cutting, tearing, severing</td>
<td>1.1</td>
<td>1.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>95.5</strong></td>
<td>100.0</td>
</tr>
</tbody>
</table>
### Secondary Mechanism

<table>
<thead>
<tr>
<th>Major underlying mechanism of sports-related injury episodes</th>
<th>No. of episodes ('000)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Blunt force</strong></td>
<td>53.6</td>
<td>98.4</td>
</tr>
<tr>
<td>Falling, stumbling, jumping, pushed</td>
<td>32.4</td>
<td>59.6</td>
</tr>
<tr>
<td>Contact with person</td>
<td>11.2</td>
<td>20.5</td>
</tr>
<tr>
<td>Crushing</td>
<td>5.6</td>
<td>10.3</td>
</tr>
<tr>
<td>Transport injury event</td>
<td>2.5</td>
<td>4.6</td>
</tr>
<tr>
<td>Contact with object or animal</td>
<td>1.9</td>
<td>3.5</td>
</tr>
<tr>
<td><strong>Physical over-exertion – Acute over-exertion, over-extension</strong></td>
<td>0.8</td>
<td>1.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>54.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Body parts injured in sports-related injury episodes</td>
<td>No. of episodes ('000)</td>
<td>%</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>------------------------</td>
<td>----</td>
</tr>
<tr>
<td>Lower limbs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ankle, foot and / or toe</td>
<td>42.0</td>
<td>43.9</td>
</tr>
<tr>
<td>Knee and / or lower leg</td>
<td>21.8</td>
<td>22.8</td>
</tr>
<tr>
<td>Hip and / or thigh</td>
<td>2.2</td>
<td>2.3</td>
</tr>
<tr>
<td>Upper limbs</td>
<td>23.5</td>
<td>24.6</td>
</tr>
<tr>
<td>Wrist, hand and / or finger</td>
<td>17.7</td>
<td>18.5</td>
</tr>
<tr>
<td>Shoulder and / or upper arm</td>
<td>3.7</td>
<td>3.9</td>
</tr>
<tr>
<td>Elbow and / or lower arm</td>
<td>2.1</td>
<td>2.2</td>
</tr>
<tr>
<td>Trunk</td>
<td>8.4</td>
<td>8.8</td>
</tr>
<tr>
<td>Lower back and / or lower spine</td>
<td>3.6</td>
<td>3.7</td>
</tr>
<tr>
<td>Upper back and / or upper spine</td>
<td>1.9</td>
<td>2.0</td>
</tr>
<tr>
<td>Chest, abdomen and / or pelvis</td>
<td>1.7</td>
<td>1.8</td>
</tr>
<tr>
<td>Neck</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Head</td>
<td>5.9</td>
<td>6.1</td>
</tr>
<tr>
<td>Head</td>
<td>2.4</td>
<td>2.6</td>
</tr>
<tr>
<td>Face, including nose</td>
<td>2.4</td>
<td>2.5</td>
</tr>
<tr>
<td>Eye(s)</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Other body parts</td>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td>Number of days off school temporarily</td>
<td>No. of episodes ('000)</td>
<td>%</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>------------------------</td>
<td>----</td>
</tr>
<tr>
<td>0.5 – 1.0 day</td>
<td>5.3</td>
<td>35.7</td>
</tr>
<tr>
<td>1.5 – 5.0 days</td>
<td>4.5</td>
<td>30.1</td>
</tr>
<tr>
<td>5.5 – 10.0 days</td>
<td>1.5</td>
<td>10.0</td>
</tr>
<tr>
<td>10.5 – 20.0 days</td>
<td>1.3</td>
<td>9.0</td>
</tr>
<tr>
<td>20.5 – 30.0 days</td>
<td>1.3</td>
<td>9.1</td>
</tr>
<tr>
<td>More than 30.0 days</td>
<td>0.9</td>
<td>6.1</td>
</tr>
<tr>
<td>Total</td>
<td>14.8</td>
<td>100.0</td>
</tr>
</tbody>
</table>

- 18.9% (or 87 000) sustained by students
- 17.1% (or 14 800) caused the injured students to be off school temporarily.
Employed Persons

- 55.4% (or 255,000) of them were sustained by employed persons.
- Less than 1% of them caused the injured employed persons to lose their jobs whereas 1.8% of them had caused the injured employed persons to lose their ability to work.
- Slightly more than half (51.3%) of these 255,000 injury episodes sustained by employed persons caused the injured employed persons to be off work temporarily.
## Medical Expenses

<table>
<thead>
<tr>
<th>Total medical expenses (HK$)</th>
<th>Traffic</th>
<th>Sports</th>
<th>Sprain</th>
<th>Falls</th>
<th>Hit / struck</th>
<th>Animal bite</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of episodes ('000)</td>
<td>%</td>
<td>No. of episodes ('000)</td>
<td>%</td>
<td>No. of episodes ('000)</td>
<td>%</td>
<td>No. of episodes ('000)</td>
</tr>
<tr>
<td>0</td>
<td>*</td>
<td>1.0</td>
<td>1.5</td>
<td>3.1</td>
<td>3.6</td>
<td>2.4</td>
</tr>
<tr>
<td>1 – 50</td>
<td>*</td>
<td>12.2</td>
<td>18.7</td>
<td>15.7</td>
<td>13.2</td>
<td>27.3</td>
</tr>
<tr>
<td>51 – 100</td>
<td>2.0</td>
<td>12.0</td>
<td>7.1</td>
<td>11.0</td>
<td>14.9</td>
<td>12.5</td>
</tr>
<tr>
<td>101 – 250</td>
<td>1.8</td>
<td>10.9</td>
<td>8.5</td>
<td>13.0</td>
<td>13.0</td>
<td>10.9</td>
</tr>
<tr>
<td>251 – 500</td>
<td>2.9</td>
<td>17.7</td>
<td>11.5</td>
<td>17.7</td>
<td>13.8</td>
<td>11.6</td>
</tr>
<tr>
<td>501 – 1,000</td>
<td>0.9</td>
<td>5.5</td>
<td>11.2</td>
<td>17.2</td>
<td>26.0</td>
<td>21.9</td>
</tr>
<tr>
<td>1,001 – 2,500</td>
<td>2.0</td>
<td>12.3</td>
<td>5.9</td>
<td>9.0</td>
<td>13.1</td>
<td>11.0</td>
</tr>
<tr>
<td>2,501 – 5,000</td>
<td>1.5</td>
<td>9.2</td>
<td>4.4</td>
<td>6.7</td>
<td>7.7</td>
<td>6.5</td>
</tr>
<tr>
<td>5,001 – 10,000</td>
<td>1.8</td>
<td>11.0</td>
<td>0.8</td>
<td>1.2</td>
<td>1.6</td>
<td>1.4</td>
</tr>
<tr>
<td>More than 10,000</td>
<td>3.5</td>
<td>21.4</td>
<td>0.8</td>
<td>1.3</td>
<td>4.6</td>
<td>3.9</td>
</tr>
<tr>
<td>Refusal</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Unknown</td>
<td>/</td>
<td>*</td>
<td>1.8</td>
<td>2.7</td>
<td>4.7</td>
<td>4.0</td>
</tr>
<tr>
<td>Total</td>
<td>16.5</td>
<td>100.0</td>
<td>65.1</td>
<td>100.0</td>
<td>118.8</td>
<td>100.0</td>
</tr>
</tbody>
</table>

- **Median (HK$)**: 2,500, 300, 500, 300, 100, 600
- **Mean (HK$)**: 12,137.8, 2,656.8, 1,915.9, 1,331.0, 898.1, 581.0
- **Standard error of mean (HK$)**: 7,332.234, 1,869.240, 514.865, 200.910, 464.565, 245.087
Classification of Sports Injuries: Tissue-based

- Soft tissue injuries:
  - Skin, fascia
  - Muscle-tendon unit
  - Muscle compartment
  - Intervertebral disc
  - Joint structures:
    - Ligament
    - Capsule
    - Fibrocartilage
    - bursa

- Hard tissue injuries:
  - Acute bony fracture
  - Stress fracture
  - Hyaline cartilage
  - Periosteum

- Special tissue/organ:
  - Brain, nerve
  - Eye, nose, teeth
  - Thoracic/abdominal organ
Sports Injuries Classification by cause...

Injury

- Incidental
  - Intrinsic (e.g. pulled muscle, ruptured tendon)
  - Extrinsic (eg. impact from cricket ball, fractured wrist - fall from apparatus)

- Over-Use
  - Intrinsic (e.g. Achilles tendonitis, stress # tibia)
  - Extrinsic (eg. blister on gymnast’s hand)
Treatment of Sports Injuries

- Prevention
Overuse Injuries

Primary extrinsic factors

• Training errors: ‘Too much too soon.’
  • Too much volume
  • Too much intensity
  • Inadequate recovery
The Key to Preventing Overuse Injuries

- Proper diagnosis of the injury and the extent of the injury
  - stage any injury.

- Diagnosis of the cause of Injury.
Common causes of Overuse Injuries

- Too great the load / too much repetitions
- Poor technique or posture
- Faulty or inappropriate equipment
- Anatomical variants or malalignment
Acute Injuries
PREVENTING ACUTE SPORTS INJURIES

- Safe playing conditions

- Heat & Cold acclimatization
  - Hyperthermia: Heat & Humidity dress appropriately, Sunblock
  - Hypothermia: Appropriate clothing-multi layering

- Fluids & Electorlytes
PREVENTING SPORTS INJURIES

Proper WARMUP & COOLDOWN

- Improves performance
- Prepares psychologically
- Creates comfort zone for activity
- Relieves aches & pains of vigorous athletic activity
- Prevents Injuries
<table>
<thead>
<tr>
<th>Frequency of adopting preventive measures against sports-related injury</th>
<th>No. of persons ('000)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do warm-up exercise before participating in the sports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All of the time</td>
<td>1,901.9</td>
<td>34.6</td>
</tr>
<tr>
<td>Most of the time</td>
<td>812.3</td>
<td>14.8</td>
</tr>
<tr>
<td>Some of the time</td>
<td>807.7</td>
<td>14.7</td>
</tr>
<tr>
<td>A little of the time</td>
<td>483.7</td>
<td>8.8</td>
</tr>
<tr>
<td>None of the time</td>
<td>1,487.9</td>
<td>27.1</td>
</tr>
<tr>
<td>Total</td>
<td>5,493.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Use sunblock agent to reduce the chance of sunburn</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All of the time</td>
<td>833.1</td>
<td>14.9</td>
</tr>
<tr>
<td>Most of the time</td>
<td>607.0</td>
<td>10.9</td>
</tr>
<tr>
<td>Some of the time</td>
<td>815.7</td>
<td>14.6</td>
</tr>
<tr>
<td>A little of the time</td>
<td>538.3</td>
<td>9.6</td>
</tr>
<tr>
<td>None of the time</td>
<td>2,794.9</td>
<td>50.0</td>
</tr>
<tr>
<td>Total</td>
<td>5,589.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Schedule regular fluid break during exercise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All of the time</td>
<td>1,980.2</td>
<td>35.9</td>
</tr>
<tr>
<td>Most of the time</td>
<td>820.9</td>
<td>14.9</td>
</tr>
<tr>
<td>Some of the time</td>
<td>991.2</td>
<td>18.0</td>
</tr>
<tr>
<td>A little of the time</td>
<td>396.1</td>
<td>7.2</td>
</tr>
<tr>
<td>None of the time</td>
<td>1,333.2</td>
<td>24.1</td>
</tr>
<tr>
<td>Total</td>
<td>5,521.6</td>
<td>100.0</td>
</tr>
</tbody>
</table>
“Serious Injuries”
ACL injury in Sports

• Overall incidence:
  – 4/10000 per year (Denmark)
  – Nielsen 1991, AOS

• Gender difference:
  – M : F = 1 : 4 (NCAA)
  – Hutchison 1995, Sp Med
  – 63% ACLR are male pts.
  – Messina 1999, AJSM
Are Sports Injuries Preventable?
Why Female?

- Hormonal
  - collagen
- Structural
  - Joint laxity
- Neuromuscular
  - Adaptation
  - Imbalance
- *Murphy & Beynnon, BJSM 2003*
Risk Factors

- **Extrinsic:**
  - Playing surface, shoes
  - Match vs practice

- **Intrinsic:**
  - Notch width
  - High BMI
  - Gen. Lig. Laxity
  - LL Ratio
# Risk Factors

**Table IV. Factors thought to predispose to an ACL* rupture**

<table>
<thead>
<tr>
<th>Extrinsic (potentially changeable)</th>
<th>Intrinsic (non-changeable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength</td>
<td>Limb alignment</td>
</tr>
<tr>
<td>Conditioning</td>
<td>Physiological laxity</td>
</tr>
<tr>
<td>Shoes</td>
<td>Hamstring flexibility</td>
</tr>
<tr>
<td>Playing surface</td>
<td>Hyperextension of the knee</td>
</tr>
<tr>
<td>Proprioception</td>
<td>ACL size/thickness</td>
</tr>
<tr>
<td>Neuromuscular rhythm</td>
<td>Size and shape of femoral notch</td>
</tr>
<tr>
<td>Acquired skill and co-ordination</td>
<td>Female gender</td>
</tr>
<tr>
<td>Landing techniques, etc.</td>
<td>Hormonal influence</td>
</tr>
</tbody>
</table>

* ACL, anterior cruciate ligament
Notch Width ↔ ACL Size

- Normal ACL size
  - ACL resides in narrow notch
  - Impingement

- Smaller ACL size
  - Less tensile strength
  - Easier to rupture
Joint Laxity

- Knee hyperextension
  - Higher quadriceps activation
  - Greater anterior translation force
- Poor proprioceptive sense
Menstrual Cycle

Figure 1. Normal menstrual cycle. Solid line = relaxin; dotted line = progesterone; and dashed line = estradiol.
Limb Alignment

- Q angle – increased valgus moment & rotational forces at the knee
Neuromuscular Control

• Input – proprioceptive sense from different mechanoreceptors
Non contact ACL Injuries
Motion Analysis

• Mechanism of Injury: landing & cutting
  – On a “straight” knee (Flexion < 30’)
  – Pivoting (Internal Rotation)
  – Valgus Loading
  – Excessive Quadriceps Drawer
  – Hyperextension
Biomechanical Measures of Neuromuscular Control and Valgus Loading of the Knee Predict Anterior Cruciate Ligament Injury Risk In Female Athletes - A Prospective Study
A review of electromyographic activation levels, timing differences, and increased anterior cruciate ligament injury incidence in female athletes

- Female had 4-6 fold higher incidence of ACL injuries
- Female athletes display different neuromuscular strategies from male athletes
Landing

- Quad predominant
- Too little flexion
- Side-to-side balance
- Weak hip abductors
- Landing on hindfoot
- Landing one by one
Prevention of NCACL

- Extrinsic:
  - Shoes, surface, etc. (Olsen, Scan J Med Sc)
- Intrinsic:
  - Neuromuscular training (Myklebust, Clin J S M)
  - "ACL Friendly" Technique in cutting & landing
    - More knee flexion
    - Land with both legs
Prevent injury & Enhance Performance

- A 15 to 20 minute training programme
- Avoid vulnerable positions
- Increase flexibility
- Increase strength
- Plyometric training
- Proprioception through agility
- At least 2-3 times per week
PEP Program: Prevent injury and Enhance Performance

Field Set-Up

Area #5 Agilities
Shuttle Run / Diagonal Run

Area #2 - Stretching

Area #3 - Strength
Lunges, HS, Toe Raise

Area #1 - Warm-Up
Jog, Shuttle run, Backward run

Area #4 - Plyometrics
Side-to-side, Forward and Backward Hops

Note: Set-up one half of the field with cones 10 minutes prior to practice. This will allow for a smooth transition between exercises.
Santa Monica PEP Programme

- Avoid vulnerable positions
  - Backward run
  - Shuttle run
  - Jump landing
- Increase flexibility
- Increase strength
- Plyometric training
- Proprioception through agility
The 11 + Message

- F-MARC: FIFA Medical Assessment & Research Centre
- Training programme to strengthen LL and prevent injuries
- 10 sets of exercises (F-MARC Bricks)
- Promotion of the spirit of Fair Play
- Junge et al, AJSM 2002;30:652-659
The Bench
Strengthening of the core muscles to increase core stability.

Starting position: Lie on the stomach. Support the upper body with the arms. Place the feet vertical to the ground.

Action: Lift stomach, hips and knees so that the body forms a straight line from the shoulder to the heels, parallel to the ground. Both knees should be directly under the shoulders. Tighten the abdominal muscles and buttocks. Lift the right leg a few centimetres from the ground and hold this position for 15 seconds. Return to the starting position, relax and repeat the exercise with the left leg. Perform 1-2 times each leg.

Important: Do not move the hips upwards. Do not let your stomach drop.

Sideways Bench
Strengthening of the lateral abdominal muscles to increase core stability.

Starting position: Lie on one side. Support the upper body with one arm so that the elbow is vertically under the shoulder; forearm lies on the ground. Bend bottom knees 90°. When viewed from above, the shoulders, elbow, hips and both knees should form a straight line.

Action: Lift top leg and hips until the shoulder, hip and top leg are in straight line parallel to the ground and hold this position for 15 seconds. Return to the starting position, relax and repeat the exercise on the other side. Perform twice on each side.

Important: Do not drop the hips. Do not tilt the upper shoulder or hips forwards.
Hamstrings
Strengthening of the hamstrings.

Starting position: Kneel down with a straight upright upper body. Knees and lower legs should be hip width apart. Cross the arms in front of the body.
Have a partner pin the ankles firmly to the ground with both hands.

Action: Slowly lean forward keeping the upper body and hips straight. Thighs, hips and upper body stay in a straight line. Try to hold this straight body alignment as long as possible. When the body position can no longer be maintained by the hamstrings then use both hands to control the fall. Perform 8 times.

Important: Do not bend hips. Perform the exercise slowly.

Cross-country Skiing
Strengthening of the leg muscles.

Starting position: Stand on the right leg and let the other leg hang relaxed. Bend the knees and hips slightly so that the upper body leans forward. When viewed from the front, hip, knee and foot of the supporting leg should be in a straight line.

Action: Flex and extend the knees of the supporting leg and swing the arms in opposite directions in the same rhythm. Flex the knees as much as possible, but keep weight balanced on the entire foot. On extension, never lock the knee. Keep pelvis and upper body stable and facing forwards. Perform 15 times on the right leg, then 15 times on the left leg.

Important: Keep pelvis horizontal and do not let it tilt to the side. Do not let knees buckle inwards.
Zigzag Shuffle
Improvement of coordination and jumping technique.

Starting position: Stand at the start of the zigzag course (8 marks set 10 x 20 m), legs shoulder width apart. Bend the knees and hips so the upper body leans substantially forward. One shoulder points in the direction of movement.

Action: Shuffle sideways to the first mark, turn so that the other shoulder points to the next mark and complete the zigzag course as fast as possible. Always take off and land on the balls of the feet. Complete the course twice.

Important: Always keep upper body leaned forward with the back straight. Keep knees soft, do not let them buckle inwards.

Bounding
Improvement of jumping power and technique.

Starting position: Stand on the take-off leg with the upper body upright. The arm of the same side is in front of the body. When viewed from the front, hip, knee and foot of the take-off leg should be in a straight line.

Action: Spring as high and far as possible off the supporting leg. Bring the knee of the trailing leg up as high as possible and the opposite arm bent in front of the body when bounding. Land softly on the ball of the foot with a slightly bent knee. Cover 50 metres twice.

Important: Do not let knee buckle inwards during take-off and landing.
Preventing Sports Injuries

• NOT a Mission Impossible!
Summary

• Exercise is good for Health (CVR)

• Exercise can be bad for Health (MSK)

• Sports injury is a Health Concern

• Sports injury can be prevented
• “One World, One Dream”
• Exercise = Health !
‘Life is Movement; Movement is Life’

AADO / HKSSH Conjoint Scientific Meeting 2011

Queen Elizabeth Hospital, Hong Kong