

## The 2008 Pre-Olympic Conference on Science, Education and Medicine in Sport

Patria A Hume<sup>1</sup>, Stephen D Kara<sup>2</sup>, Liesel Geertsema<sup>3</sup> and Celeste Geertsema<sup>4</sup>

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<sup>1</sup>Institute of Sport and Recreation Research NZ, AUT University, Auckland 0627, New Zealand; [Email](#). <sup>2</sup>Papatoetoe Accident and Medical Centre, Auckland New Zealand; [Email](#). <sup>3</sup>Active Health and Injury Solutions, Christchurch, New Zealand; [Email](#). <sup>4</sup>Adidas Sports Medicine, Auckland, New Zealand; [Email](#). Reviewer: Chris J Milne, Anglesea Clinic, Hamilton, New Zealand; [Email](#).

**Biomechanics:** ankle sprain, braces, knee stiffness, knee rotation stability, discus instrumentation. **Sports Nutrition:** supplementation, IOC Diploma, fluid loss replacement, pre-match meals, post-game glycogen repletion. **Body Composition:** obesity, C-reactive protein, somatotype. **Sports Training:** biological indices, psychological state, dance proprioception conditioning, balance training. **Motor Control:** wavelet analysis, frontal lobe, parietal lobe, functional MRI, augmented feedback, feed-forward control, coincident timing performance, peripheral awareness, electroencephalograms. **Practice, Instruction, Expert Performance:** deliberate play, talent identification, implicit learning model, error-less learning, acquisition of skills. **Talent Development:** giftedness, sexual abuse, elite child athlete. **Sport Culture:** sports perfectionism. **Health Promotion:** ecological model, accumulated physical activity, social mobilization, sarcopenia, serum myostatin, hormonal intervention. **Sports Medicine:** tendinopathies in athletes, East and West, herbal medicines, acupuncture, Tai Chi, Fu's subcutaneous needling, sudden cardiac death syndrome, cardiac pre-participation screening, arrhythmia. **Injury Prevention:** hamstrings strain, Nordic hamstring stretching, non-contact anterior cruciate ligament injury, meniscal tear, post operative rehabilitation programs, balance and wobble board, ankle sprain, FIFA-11. **Football Symposium:** non-contact injuries, moral taxonomy, performance characteristics, high intensity training. **Pre-Olympic Conference 2012:** in Glasgow. **KEYWORDS:** elite athletes, injury prevention, talent, training, culture.

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The inaugural Pre-Olympic conference incorporating the Federation of International Sports Medicine (FIMS), the International Para-Olympic Committee (IPC), the International Council for Sports Science and Physical Education (ICSSPE) and the International Olympic Committee (IOC), was held in Guangzhou, China at the Oriental Convention Hotel from 1-5 August 2008. The convention centre covered one-third of a square kilometer and was six stories high. It took more than ten minutes to walk from one end of the exhibition centre to the other, so you had to be well prepared for the sessions you wanted to see. The Chinese experience involved communication, dietary, and other cultural differences as well as Olympic security, as this was viewed as an additional Olympic venue.

The five-day conference was a combination of 12 keynote addresses, 32 symposia, oral and

posters presentations. Of the 3400 submitted abstracts, 371 were podium and 998 were poster presentations. There were usually 10 concurrent streams to choose from each day of the conference. Streams covered a wide range of topics in the discipline areas of sport and exercise science, sports medicine, physical education and sports-related social science. The combined nature of this conference attracted attendees from very different realms in the sporting world: scientists, ethicists, practitioners, administrators, therapists, and philosophers. Overall, the quality of the free communications and posters was inferior compared with those at other international conferences, but the symposia were good. Here are the highlights:

- **Reduction of lower limb injuries** (ankle sprain, non contact ACL rupture and hamstring strain) can be achieved with structured supervised regular pre-habilitation and reha-

bilitation plans.

- **Talent identification programs** should include motivation of the player, as motivation correlates with additional play and training not led by the coach, leading to performance improvement.
- **Implicit learning models** are finding increasing popularity, as they potentially provide less destabilization when a player is in competition.
- **Training the elite child athlete** is the topic of a useful IOC consensus statement.
- Practical information and research on reducing risk of **athletic injury** is available from the website of the [Oslo Sports Trauma Research Centre](#).
- **Strength training in the elderly** population counters the effect of muscle wasting, but maintaining adherence is the challenge.
- The **IOC Diploma in Sports Nutrition**, a [two-year distance-learning program](#) coordinated by Ron Maughan, Susan Shirreffs and Louise Burke, was promoted in several sessions.

### Biomechanics

The biomechanics theme included presentations on methodology, analysis of movements and elements, mechanisms of strength training, biomechanics analysis of sports injury and rehabilitation. Yue Yan Chan (The Chinese University of Hong Kong) showed a **new mechanical supination sprain simulator** that has a rotating platform to allow plantar flexion, dorsiflexion or a combined motion. Unfortunately the device does not allow control of the tilt range of motion. Man-Ling Chung (The Chinese University of Hong Kong) then reported on an experimental study that showed that the **Air-stirrup ankle brace** reduced and delayed ankle joint motion during a simulated ankle supination sprain on the simple free-fall mechanical supination sprain simulator. The brace may be effective in protecting the ankle from sprain injury, as it restricts and delays the spraining motion.

Tik Pai Fong (The Chinese University of Hong Kong) presented a case study from the lab where a person had sustained a grade-1 sprain during testing. There was a higher loading rate at the heel initially with transfer to the forefoot. It was surprising that the ankle sprain

occurred in dorsiflexion rather than the usual mechanism of plantar flexion and inversion. It was suggested that the heel should be down during landing to avoid ankle sprain.

Corey Scholes (Queensland University of Technology, Australia) outlined the **regulation of sagittal knee stiffness** and the test-retest variation in stiffness. Twelve healthy male volunteers performed 60 step-down landings from a knee-high platform with one minute rest between trials. It was concluded that some individuals may increase or decrease landing stiffness to a preferred level during repeated trials without the presence of external feedback.

Mak Ham Lam presented a review of literature on the biomechanics technique to evaluate **knee rotation stability**. The findings provide an overview of knee rotational stability measuring techniques for orthopedic specialists and sport biomechanists to choose the most suitable protocol for specific application, for example, to evaluate the surgical outcome of anatomical double-bundle anterior cruciate ligament reconstruction.

### Sports Nutrition

Ron Maughan (Loughborough University, UK) chaired the sports nutrition symposium that included speakers Susan Shirreffs (Loughborough) and Stephen Wong (Chinese University of Hong Kong). Although no new information was presented the following summarizes the content from the presentations:

- The Maughan Rule to **supplementation** is “if it works then it is probably banned, and if it is not banned then it probably does not work!”
- Athletes can obtain their nutritional requirements from a balanced diet ensuring that the essentials of carbohydrate, protein, fat, vitamins, minerals, fiber and water are attended to.
- Carbohydrate intake guidelines of 5-7 g/kg body mass in moderate training and up to 10 g/kg during heavy training.
- Protein intakes >1.7 g/kg/day are not necessary.
- Energy intake is best measured by monitoring body weight and skin folds.
- Acute post-exercise creatine supplementation and high carbohydrate intake increases muscle glycogen at three and six days post exercise.

- 2% body mass loss (as a measure of hydration status) is the level above which detrimental performance effects will occur, but this figure may be less if heat is involved. (especially temperature >30°C)
- **Replace fluid losses** at 150% of weight loss. (We note that this percentage is contentious given the possible risk of hyponatremia).
- The effectiveness of fluid replacement is improved with higher concentrations of Na<sup>+</sup>, which can be obtained from rehydration fluids (although Na<sup>+</sup> concentration is limited by palatability) or food. K<sup>+</sup> concentration is not an issue.
- Individualize fluid and recovery regimens
- **Pre-match meals** consisting of low glycemic index foods sustain carbohydrate availability and maintain blood glucose levels during exercise.
- **Post-game glycogen repletion** is best achieved with high-glycemic index foods.

### Body Composition

Patricia Wong (Nanyang University, Singapore) described how **obesity** affects the relationship between functional capacity and **C-reactive protein** in male adolescents in Singapore. Statistically significant differences in C-reactive protein level, lipid profiles, body composition and functional capacity between obese and normal-weight adolescents were observed. Improvement in functional capacity may be a useful intervention in lowering C-reactive protein levels for the obese individuals, thereby ameliorating the inflammatory status, with or without substantial weight loss.

Yin, Zenong (University of Texas, USA) reported effects of physical activity frequency and adiposity level on body composition and fitness in children. Moderate-vigorous physical activity for at least 60 minutes on most days of the week was associated with favorable changes in body composition and fitness in 604 students from 18 elementary schools.

Faradjzadeh Shahram (National Olympic and Paralympic Academy, Iran) presented the somatotype and body composition of 45 Iranian men's wushu, tae kwon do, wrestling, judo, and karate national team athletes taking part in the Doha 2006 Asian Games to provide cross-sectional norms for the purpose of talent identification for combat sports. The combat sport

demonstrating greatest evidence of physical homogeneity was wushu, while judo had least homogeneity. Decreased homogeneity was attributed to the extensive range of weight classifications.

### Sports Training

The sports training theme included presentations on coaching and the coaching process, talent identification and early development, training, and new technology in sports. Ye Tian (China Institute of Sport Science, China) gave a keynote on monitoring of sport training and regulation of competitive state in elite athletes. Scientific training monitoring is important in evaluating training workloads, assessing exercise-induced fatigue and preventing overtraining. **Biological indices** are used as guides to training. Monitoring in sports training involves diagnosis of physical functioning, assessment of **psychological state**, and analysis of movement techniques. Regulating elite athletes' competitive state can not only enhance athletes' sporting competence but also give full play to their acquired maximum sporting competence in competition. The regulation of competitive capacity by means of experimental testing is primarily based on regulating physical competitive capacity, regulating mental competitive state, prevention and treatment of athletes' injuries and illnesses, and traditional Chinese medicine.

Carla Murgia (Delaware State University, USA) reported the positive effects of **dance proprioception conditioning** and resistance band training for 10 weeks on joint kinesthesia and injury prevention in 92 female elite gymnasts aged 13 to 21 years. Paul Fiolkowski (University of East London, UK) also showed the effectiveness of a 6-week **balance training** program (a wobble board or T-band kicks, training three times/week for six weeks) on lower leg muscle activation and balance for 12 normal subjects.

### Motor Control

Raymond So (The Hong Kong Polytechnic University) conducted electromyographic time-frequency **wavelet analysis** of quadriceps muscle during repeated maximal isokinetic knee extension and flexion exercise performed on a Biodex System for 11 active young males. He documented the shift of the frequency intensity that relates to the decline of dynamic muscle

power.

Luduan Zhang (Cleveland State University, USA) examined motor command for activating and relaxing leg muscles from different regions of the brain in 12 young healthy volunteers. The primary control area generating the command to initiate voluntary knee extension is in the **frontal lobe** near the motor cortices, while that to initiate extension is in the **parietal lobe** close to the sensorimotor integration regions.

A **functional MRI** study on 12 subjects by WanXiang Yao (University of Texas, USA) showed that brain activities during eccentric and concentric muscle contractions may depend on resistance load at or above 30% of MVC. Qin Lai (Wayne State University, USA) showed that for 33 subjects, feed-forward control and consequently skill acquisition on balance can be enhanced if providing **augmented feedback** simultaneously with practice as concurrent feedback. Learning a target sinusoid on a stability platform places high demands on **feed-forward control** or anticipation, since subjects have to consistently shift body weight and overcome body perturbations.

John Liu (Springfield College, USA) investigated the effects of different object speeds and ranges of limb movement on coincident timing performance of 35 male and 33 female college student athletes. **Coincident timing performance** was affected by range of limb movements, suggesting that large range of movements could lead to more timing errors and pose a greater challenge to the performer. Knowledge of results regarding timing accuracy and direction error was essential to improvement in coincident timing performance regardless of object speeds. Male performers appeared to utilize external, augmented feedback for coincident timing performance more effectively, whereas female performers tended to be more effective in using, natural, internal movement information for performing the coincident timing skill.

The role of **peripheral awareness** in decision making and sport performance was outlined by Jannie Ferreira (University of Johannesburg, South Africa). In the study of 30 elite rugby backline players, the higher the decision making rating (based on coaches ratings of players using a Verusca analyzing system of five rugby matches) the better the players scored on the central peripheral awareness test

(based on the Wayne Saccadic Fixator score).

Liya Lin (Guangdong Provincial Institute of Sports Science, China) analyzed compressed spectral array **electroencephalograms** to evaluate the effects of high-altitude training on adaptation in nine elite swimming athletes from the Guangdong Swimming Team before competition. After high-altitude training, the average frequency of brain information distribution was higher than before high-altitude training. The lack of oxygen creates changes in brain function to which the body adapts.

### **Practice, Instruction, Expert Performance**

Mark Williams (Liverpool John Moores University, UK) chaired the session that included Richard Masters (Liverpool John Moores) and Jonathon Maxwell (University of Hong Kong). What makes the difference between elite and non-elite athletes? The view that “elite athletes are born” does not appear to hold true. While the old adage of 10 years and 10,000 hours = elite level (equating to 20-30 hours per week) still holds some truth, it is not necessarily coached time and game time that are needed to achieve these numbers. More evidence around **deliberate play** or non-coached play (e.g. street soccer, backyard cricket) can and should provide an important contribution to performance improvement. Elite athletes are better at anticipating what is going to happen through visual cues, recognition of patterns or structures and more accurate search strategies of the opponent leading to a refined increased in the possible outcomes and better tactical decisions. It is not as simple as “**talent identification**” either. Motivation of the athlete (both internal and external) would appear to be the most important factor (probably a strong correlation with deliberate play) in addition to traditional talent identification factors. Interesting data from European soccer academies showed that despite the same anthropometric data your chance of selection into an academy was improved if your birth data fell within the first three months of the selection year!

Our theoretical understanding of practice and instruction in sport has turned more towards an **implicit learning model** (automatic) as opposed to the more conscious explicit model, which can be destabilized under competition pressures. Implicit learning techniques have been evolving in training situations with the use

of dual task learning, but newer strategies include analogy learning and errorless learning. **Errorless learning** with under-developed cognitive resources (e.g., young children who have not programmed their minds with previous error-ridden experiences) may benefit from this type of learning. Jonathon Maxwell presented evidence of such a technique by getting children to start learning golf putting starting close to the hole and then they got progressively further away from the hole but noticeably trusted their learnt technique and did not try to change what they were doing. Again, when under pressure, their success rate did not alter. Perhaps error-less learning could also be used for the poorly coordinated child who avoids the task as it is too hard and they learn to fail. Whether error-less learning is valid in an adult-trained population is not known. Training an athlete revolves around the **acquisition of skills** and perhaps it is time that we demand of coaches to use evidence-based training methods.

#### Talent Development

Tricia Leahy (Hong Kong Sports Institute) talked about developing **giftedness**, where the aim is to pursue excellence in the international arena. “The athlete entourage” concept assumes we need sport-science support for the athlete and coach and uses a bio-psycho-social paradigm. Characteristics of effective scientific support systems should include multidisciplinary teams with practice informed by science, scientist-practitioner strong links, on-field sport science provision, sport-specific expertise and a highly individualized approach. The question to ask is whether the scientific support systems are helping. Tricia then reported some statistics that stunned the audience. Apparently there has been criminal **sexual abuse** in 15% of the total Australian elite sport members, and of those who had been abused 50% had sustained abuse in sport. Most abuse occurs in an environment of fear and entrapment where the person is confused. As sport has an emotionally intense environment there is a need for a code of ethics and for education about ethical competencies for sport scientists and coaches. Silence about perpetrator abuse needs to stop and bystanders need to report incidents. Parents need to be involved in monitoring behavior but can also be part of the bad environment (e.g., parents shouting from the sideline). Tricia recommended

reading the [2005 consensus statement on training the elite child athlete](#) at the [IOC's official document site](#).

#### Sport Culture

Sigmund Loland (Oslo Sports Trauma Research Centre, Norway), a sports philosopher, opened the conference with his keynote presentation entitled *Citius, Altius, Fortius? Moral and immoral interpretations of athletic performance*. He presented three models of sports performance and how each affected the individual and society as a whole. While **sports perfectionism** was his ideal (a model in which the rules that govern fair sport are also applied outside of this realm in society as a whole), he concluded that we live in a changing environment and others view this model as outdated. Perhaps we will see the “Olympic ideal” retained while other sports will provide the entertainment factor with the use of biotechnological and medical advancements.

#### Health Promotion

The health promotion theme included presentations on physical activity promotion and programming, epidemiology of injury and illness, population-based surveillance and disease prevention and treatment, physical exercise, Tai Chi Chuan and other Chinese martial arts. Victor Matsudo talked about mobile management using an **ecological model**. Moderate activity is enough to protect against cardiovascular disease. **Accumulated physical activity** works. Interval activity is actually slightly better so the suggestion is to try 3x 10 minutes brisk walk at least 30 minutes per day and 5 days per week. The “half hour man” (a clock cartoon) is used to encourage physical activity. There is also advocacy at the medical level with pill boxes that are empty but contain physical activity messages on the outside. The message is that physical activity is the best medicine. Relative risk of illness or injury multiplied by peoples’ indignation of the cost or other effect of the illness of injury is equal to the social perception of risk. Sufficient social perception of risk leads to **social mobilization**—getting people to want change—which will increase physical activity in the population.

Walter Fontera (President of the International Sports Medicine Federation, Harvard University) elegantly presented the phenomenon of **sarcopenia** (loss of muscle mass) as a physiological change with age and its contribu-

tion to loss of function. In his keynote presentation titled *Ageing – How Can Exercise Help?* he stated that the elderly fear losing independence more than death. Sarcopenia as an entity is not well defined in the literature, with no specific definitions when compared to other ageing changes such as osteoporosis. It is associated with a reduction in physical activity, low body weight, smoking, and a reduction in Vitamin D and testosterone levels. Cross-sectional studies in the knee and elbow show a reduction in isokinetic strength of between 15–26% in this population. This loss of muscle mass is not just muscle atrophy: the amount of intra and intermuscular adipose deposition (non contractile tissue) increases with age and there is a reduction in the quality of the muscle fibers that remain. On a molecular level there is increased synthesis of **serum myostatin** which is a negative regulator of muscle mass resulting in a decrease in muscle protein concentration per fiber. In addition there is an increase in glycosylation and oxidation of muscle proteins. Walter Fontera presented information pertaining to strength or resistance training and suggested that with standard exercise prescription (2–6 sets per session for each muscle group, 5–15 reps per set, 6–9 s per rep (slow), 40–90% of 1 RM, 2–5 days per week) that in 12 weeks we are able to replace what has been lost over several years. But the response rate varies between individuals, with 10–180% increase in strength from baseline. While there may also be differences in muscle hypertrophy between individuals, muscle strength and level of functioning are more important measures. These improvements are due to a reduction in myostatin levels post exercise and the anti-inflammatory effect that exercise provides; it also helps if you have a particular allele of the IGF-1 gene.

Walter believes the way forward is to combine aerobic exercise, resistance training and flexibility for the elderly, but the challenge is to combine them in such a way as to maintain adherence. Additional strategies that have been investigated include **diet** (an increase in protein intake is advisable and has been shown to have a synergistic effect with exercise prescription of between 3–6 hours per week in the elderly), and **hormonal intervention** (testosterone, human growth hormone, insulin-like growth factor, and myostatin inhibitors). There are only small

short-term studies in the literature, and while they show benefit, either their short-term side effects preclude use (e.g., myostatin inhibitors) or we do not know the long-term risks.

### Sports Medicine

Savio Woo (University of Pittsburg, USA) chaired a symposium on **tendinopathies in athletes**, featuring orthopaedic surgeons Kai-Ming Chan (Chinese University of Hong Kong), Chig-Jen Wang and Chih-Hwa Chen (both from Chang Gung University, Chinese Taipei). The pathogenesis, biochemical and histological changes at the tendon level with the abnormal healing concept were outlined. Weak evidence for the use of extra-corporeal shock-wave therapy in the treatment of plantar fasciitis, calcific rotator cuff tendinitis, lateral epicondylopathy and patellar tendinopathies was presented by Chig-Jen. Surgical management for chronic overuse syndromes such as chronic Achilles over-use injury, chronic patellar tendon over-use injury and chronic tennis elbow overuse injury were presented by Chih-Hwa, but he did not add any new information. The holistic approach to tendinopathies – a Traditional Chinese medicine model – was an interesting look at East and West presented by Kai-Ming, but he admitted to no actual hands-on use of such a model! For those involved with Asian athletes, knowledge of these alternative treatment strategies that patients may be seeking provided some useful information. Traditional Chinese medicine involves the synergistic use of **herbal medicines** applied orally or topically (to provide anti-inflammatory action, promote micro-circulation, promote matrix deposition, and reduce adhesions), **acupuncture** as a pain relief, **manipulative therapy** (tuina) for mechanical stimulation of remodeling and **Tai Chi** as a functional exercise regimen incorporating proprioception and restoration of tendon function. These strategies are applied simultaneously and not in a step-wise fashion, as each has its own scientific pathway (not actually presented or known) with clinical relevance in the holistic management of tendinopathies. Will East and West ever meet on this issue?

Tianjun Wang presented the effect of **Fu's subcutaneous needling** (FSN) for tennis elbow. Normal-needling acupuncture was compared with FSN. According to the uncontrolled

clinical trial FSN was quicker and better. With FSN the needle is put in under the skin but not in the muscle, and is moved for one minute then left in for 24 hours. The FSN tube creates tension under the skin. Patients reported no pain when the needle was in. Only one treatment per week was needed for FSN compared with acupuncture of three times per week. Tianjun reported that 18 of 48 patients were cured in one week using FSN and overall there were significant beneficial differences in curing rates with FSN compared to acupuncture. There was no suggestion of the mechanism by which FSN would work. This may be a technique that can reduce pain in athletes, if it is not all down to the placebo effect of novelty.

Sport related **sudden cardiac death syndrome** is a constant reminder to the hazard of sport and exercise participation. Fabio Pigozzi (University of Rome, Italy) chaired the athletic heart symposium with speakers Hans Dickhuth (University of Freiburg, Germany) and Antonio Spataro (University of Rome, Italy). Hans Dickhuth outlined the morphologic and functional features of the athlete's heart. Recognized cardiac morphological and functional adaptations that are nowadays termed the athlete's heart include most notably an increase in left ventricular end diastolic cavity dimension and wall thickness, resulting in increased left ventricular mass. Athlete's heart is the result of chronic dynamic training and is not seen in static training (e.g. runners versus weightlifters). These adaptations will begin to regress as early as three weeks post training with bed rest. In addition there is no evidence that such adaptive changes predispose to long-term cardiac damage or abnormalities.

An Italian perspective of **cardiac pre-participation screening** was provided by Antonio Spataro and Fabio Pigozzi. While death from cardiac causes during sports participation is not a new entity, the role of the media and fan interest serve to highlight such tragic events. This dramatic event occurs at a rate of one in 100,000–300,000 per annum in athletes under the age of 35 years, 75% of the time in competition. Etiology varies by geographical region with hypertrophic obstructive cardiomyopathy and anomalous coronary artery common in USA (36% and 12% respectively), arrhythmogenic right ventricular dysplasia and

anomalous coronary artery common in Italy (23% and 12% respectively), myocarditis common in Germany and Marfans syndrome common in China. Ventricular tachycardia sometimes precedes fatal ventricular fibrillation, so the early activation of CPR and the use of an automatic external defibrillator are paramount to survival. Unfortunately survey data from 2005 showed that success rate with an automatic external defibrillator with those under 30 years of age is very low.

The Italians presented a more aggressive model (in use since 1971) of compulsory pre-participation cardiac screening for those involved in competitive sports. In 2003 it was estimated that 5 million people had undergone pre-participation cardiac screening annually. Yearly medical history, physical examination and a 12-lead ECG both at rest and after a three-minute step test provided them with a 96% negative predictive value and a 90% reduction in sudden cardiac death over 30 years. But while it served as a useful reinforcement of a structurally normal heart, the positive predictive value was low and the false-positive rate was high mainly due to the athletic cardiac adaptations that occur with training and the changes that these make to the ECG. While 80% of patients with minor ECG changes (such as non specific T wave inversion, R and S wave voltage increases and deep Q waves) will have structurally normal hearts, according to the speaker the rest may proceed to clinically significant disease and therefore must be followed routinely for determining risk of sudden cardiac death.

This series of lectures raised more questions than it answered. What is the financial cost to the public or individual or sporting organization of such an aggressive regimen with a high false-negative rate? What is the resource accessibility and availability needed to cope with the demands of ECG interpretation and ultimately echocardiography referral? Why annual screening? It is a useful reminder of the purposes of screening and the rules that govern the usefulness of a test as a screening tool. Chris Milne, in reviewing our conference report, made the following comment... "The Italians are in a club of one when it comes to their recommendations re routine pre-participation ECG screening. The consensus amongst clinicians is that a

lot of the Italians' cardiac problems are due to a small genetic pool in the communities studied, and would not be replicated elsewhere. Also, the number of false positive results generated causes flow-on effects and much human angst." For an overview on pre-participation screening see Pigozzi et al. (2003).

### Injury Prevention

The Norwegian team of Grethe Mykleburst, Lars Engebretson and Tron Krosshaug, all from the Oslo Sports Trauma Research Centre, delivered an excellent presentation on **injury prevention in sports** focusing on the lower limb. Examples were provided for hamstrings strains, non-contact ACL injuries and ankle sprains. Their research and intervention strategies that revolve predominantly around the sports of handball, soccer and alpine skiing can be viewed on-line at [www.ostrc.no](http://www.ostrc.no) or [www.skadefri.no](http://www.skadefri.no); the latter is in Norwegian but be translated into English in the near future.

Most studies defining **hamstrings strain** risks are too small to make moderate causality associations, but age and previous injury are well recognized risk factors for this type of injury. Muscle overload in eccentric contraction with the knee in 20-70° of flexion appears in kinematic studies as the defining mechanism for hamstring strain. The implementation of a prevention strategy using the Nordic or Russian Drop Protocol is well known and has shown a dramatic reduction in hamstring injuries. **Nordic hamstring stretching** (3x 30 s) should be included during warm-up and also completed three times per week for 5-10 minutes each session. The Nordic program should be completed three times per week pre-season and two times per week in-season. Attention to detail and oversight are the key factors in improving athlete compliance in this area. Ropes or belts should be used to control the drop to the point of muscle tightness/pain in the initial stages to reduce delayed onset muscle soreness that limits such an activity.

The incidence of **non-contact anterior cruciate ligament (ACL) injuries** is much higher in woman's sport (soccer, handball, basketball and gymnastics) especially those in the second decade of life, with a 5:1 gender ratio. ACL injury registry databases have been set up in the Scandinavian countries over the past four years for patients undergoing surgical repair for ACL

ruptures. The injury rate across all sports is higher in competition than in training. There are many other risk factors, which can be divided into external (e.g., competition rather than practice, footwear with a higher number of cleats, surfaces such as artificial versus wooden floors, meteorological conditions such as lower rainfall) and internal (smaller intercondylar notch width or smaller ACL, lateral versus medial posterior tibial slope, pre-ovulatory versus post-ovulatory menstrual cycle phase) but are again based on small studies and generally only look at one variable at a time. In published kinematic studies there is agreement that most injuries to the ACL are sustained in the pivoting or plant foot and cut (60%) and one-legged landing (30%) with the knee moving into a valgus position within a short time frame of the foot contacting the surface (within 33 ms) in addition to anterior tibial translation with the knee in a small range of flexion.

Diagnosis of ACL injuries can be based on extreme acute knee pain post strenuous activity, inability to carry on activity, a 'pop' sensation in the knee, hemarthrosis, a positive pivot shift test to rule in ACL injury, a negative Lachman test to rule out ACL injury. An MRI will accurately diagnose ACL injury in 95% of cases.

ACL injuries are uncommonly associated with other knee ligament injuries: only 1% have an associated lateral collateral ligament tear while 5% have an associated medial ligament injury. However, up to 50% have an associated **meniscal tear**—more commonly lateral meniscus in the acute situation and medial meniscus in the chronically ACL deficient knee. No treatment intervention has been shown to alter the risk of osteoarthritis development.

Patients can be divided equally between being copers (able to cope with level of activity), non-copers, and adaptors (adapt level of activity to deal with ACL deficient knee) but currently we are not able to predict who will fall into which category. Perhaps those who do not cope have ongoing chondral damage due to anterior tibial translation or rotational movement. Treatment choices between surgical and rehabilitation versus rehabilitation alone should be tailored to the individual. Surgical interventions utilize bone-tendon-bone grafts or hamstring grafts and newer techniques are using double bundle rather than single bundle grafts to con-

trol rotation and possibly reduce osteoarthritis risk. If non-surgical rehabilitation alone is the treatment of choice, the patient should be reassessed at 3–4 months. If there is recurrent instability or patient unease then delayed surgery can be an option. **Post operative rehabilitation programs** will vary with surgeons but all should involve early quadriceps activation, range of motion exercises with the aim for full knee extension, and early closed-chain kinetic exercises, with quadriceps strengthening and neuromuscular training to ensure knee joint stability.

Implementation of prevention programs involves neuromuscular and proprioceptive training regimens to reduce dynamic loading at the tibio-femoral joint. In Norway prevention programs involve **floor, balance and wobble board exercises** with five minutes at each station for a 4–6 week period and then weekly in-season. Balance prevention programs showed a dramatic reduction in the number of injuries but discontinuation of the program once again saw the numbers of non-contact ACL injuries rise. This training should be done at the beginning of a training session to reduce the impact of fatigue on control. Ideally it would not be in isolation and as part of the structured team warm-up (cutting moves concentrating on knee over the second toe concept, two feet landing and multi-step deceleration methods) with additional wobble board strategies. Coaches nationwide in Norway are using the injury prevention program. The importance of general aerobic fitness, strength, plyometrics and stretching should not be forgotten as components of any prevention strategy. The speaker recommended the IOC's current concepts statement on non-contact ACL injuries in female athletes (Renstrom et al., 2008).

High numbers of **ankle sprain injuries** are well documented in sport. The main mechanism of ankle sprain is ankle inversion and plantar flexion prior to contacting the surface and rolling into supination. Common causes are players being hit from the medial side (soccer tackle) or landing on an uneven surface (an opponent's boot). Risk is identified as greater for those with a preceding ankle injury. Prevention includes strategies such as bracing or taping (orthoses) especially in those with previous ankle injuries, balance board training for 10

minutes five times per week for 10 weeks after an acute injury and then for 5 minutes three times per week, and an adequate rehabilitation program post injury (including continued taping until at least rehabilitation has been completed).

Grethe Myklebust stated that continual promotion of injury prevention programs was important to maintain the injury reduction. An example was given from the handball study, where there was a decrease in injury rates when the intervention was put in, then two years without the intervention where the rate went up, then re-intervention where the rate went down again. An evaluation of the FIFA-11 project was also provided, with data showing that those teams with greater compliance to the intervention program had a lower injury rate. Coaches used neck hang cards with exercises to provide options for the exercises to reduce boredom for players. Improvements to the program according to the feedback from coaches included less time needed for exercises and more exercises with the ball. The website [www.skadefri.co](http://www.skadefri.co) has all the videos that Grethe used to show the injury mechanisms.

#### **Football Symposium**

The three presenters in the **football/soccer** symposium were Albert Gollhofer (University of Freiburg, Germany), Sigmund Loland (Norwegian University of Sports Sciences), and Hans Hoppeler (Department of Anatomy, University of Bern, Switzerland). Albert Gollhofer focused on **non-contact injuries** in soccer, outlining a large list of intrinsic and extrinsic factors accompanied with situational factors that contributed to non-contact injury rates. Of these Boot stud and sprig type were examined and their effects on mechanical loading of the lower extremities were reported. His studies showed that loading of the lower extremities can be modified by football boot. In laboratory testing traditional round sprigs generate higher forces in the knee and ankle joints at low-moderate loads compared to cleats, predisposing the lower extremity to risk of injury. The effects of fatigue due to a marked reduction in active muscle control around the lower extremity joints result in additional instability.

Sigmund Loland again gave a philosophical look at the game of soccer and cheating: professional fouls, hidden fouls and play-act diving. He concluded that **moral taxonomy** is helpful

in the development of a rules system by which to deal with such offences, but the implementation of rules are dependent on the referee's interpretation of the intent of the foul. Does infringement of the rules and referees wanting more information to be able to make decisions mean further video referee input into sport?

Hans Hoppeler described **performance characteristics** in football. Soccer players (apart from the goalkeeper) cover a total distance of 10–12 km during a game, of which 20–30% is high intensity running with or without the ball and is dependent on the position. The challenge is to achieve the required aerobic capacity without a reduction in time spent on skills—hence the revival of interval training to improve VO<sub>2</sub>max. Hans described the **high-intensity training** regimen developed by Halgerd and showed a 0.5% increase in VO<sub>2</sub>max per session with a 10% overall increase in VO<sub>2</sub>max over 11 days. Generally a four-day rotational cycle repeated three times was effective. Each session consisted of a warm-up phase, followed by a high-intensity phase for four minutes, then a recovery phase for three minutes repeated three times for a total of 20 minutes. Days 1 and 3 involved two training sessions, with Day 2 having only one session and Day 4 being a recovery day. Not known is the exact mechanism by which the training

adaption occurred, so questions around how often and how long the training effect lasts remain unanswered.

### Pre-Olympic Conference 2012

The conference prior to the London Olympics will held be at the Scottish exhibition and conference centre on the banks of the river Clyde in Glasgow, Scotland in July 2012. [Link](#) for details.

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