Cure of the Disabled Athlete

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DMC Primary Care Sports Medicine

Disclosure

• None

Sports

• What do we love about sports??
Sports

- "The power of the human will to compete and the drive to excel beyond the body's normal capabilities is most beautifully demonstrated in the arena of sport."
- —Aimee Mullins

I'm from WISCONSIN
Aimee Mullins

- Fibular hemimelia
- BKA age 1
- First athlete to compete in NCAA
- First person on the carbon-fiber legs
- Paralympics
- Sports Illustrated “Coolest Girl in Sports”
- Model
- Actress

Anthony Robles

- Born without right leg
- National high school and college wrestling champion
- All-American Arizona State University student won the NCAA championship title for the 125-pound weight class division 2011
- “I didn’t get into the sport for the attention. I wrestle because I love wrestling. But if I can help change somebody’s life for the better...”
Melissa Stockwell
- US Army War veteran
- Purple Heart recipient
- AKA after roadside bomb 2004
- Paralympian
- Paratriathlete
- 2008 record holder for the 100m butterfly and the 100m freestyle
- “I can really do anything I want to do, missing leg or not,” she says.

Bethany Hamilton
- Competitive surfer since young child
- Shark attack age 13
- Surfing 1 month later
- Two years later, won 1st place Explorer Women’s Division of the NSSA National Championships

Sgt. Elizabeth Marks

Cheryl Angelelli

- Director Marketing and PR DMC RIM
- Paraswimming
- Multiple medals
- Just won medal at ballroom championship

Introduction

- 15.6% world population live with disability (WHO)
  - 1 billion
  - 54.4 million in US
- Approximately 2 million competitive disabled athletes in US
- Growth
  - 400 athletes in Paralympics Rome 1960
  - 3806 in Athens 2004

Barriers to Participation

- Awareness
- Access to care
- Consequences of injury
  - May severely affect ability to carry out ADLs
    - Importance of prevention!
Goals

- Review definitions, methods, injury rates
- Identify risk factors
- Identify areas of improvement
- Develop injury prevention strategies

Benefits

Disabled athlete vs non-athlete
- Endurance
- Muscle strength
- Cardiovascular efficiency
- Balance/motor skills/flexibility
- Fewer cardiac risk factors/higher HDL/less likely to smoke
- Amputation athletes
  - Improved proprioception
  - Increased proficiency in prosthetic use
- Paraplegic athletes
  - Less likely to be hospitalized
  - Fewer pressure ulcers
  - Less susceptible to infection

Psychological benefit
- Self-image
- Body awareness
- Mood
  - Sports positively affect psychological, social, moral development for children/adolescents regardless of presence of disability
Common Terms

Table 2
Exploration of some common terms

<table>
<thead>
<tr>
<th>Impairment</th>
<th>Disability</th>
<th>Handicap</th>
<th>Adapted sport</th>
<th>Paralympics</th>
<th>Special Olympics</th>
<th>Deaflympics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any loss or abnormality of psychological, physical, or skeletal structure or function.</td>
<td>Global term used to encompass problems with body function, body structures, activity limitations, and participation restrictions resulting from impairment (physical health organization). Impairments that limit a major life activity (motoric, with Disabilities Act)</td>
<td>A disadvantage for a given individual resulting from impairment or disability that limits or prevents the full and equal participation in the activity for which it is inherent.</td>
<td>Sport that is specifically modified or designed for the athlete who has a disability, the athlete may participate with others without disabilities (integrated settings) or only with others with disabilities (segregated settings).</td>
<td>Sports for athletes who have permanent physical disabilities; organized under the International Paralympic Committee.</td>
<td>International sports training and competitions program for persons with intellectual disability who are aged 8 and older, irrespective of their abilities (organized under the International Special Olympics).</td>
<td>Organized sports for deaf athletes, in which the athletes and officials are deaf.</td>
</tr>
</tbody>
</table>

Background

Athletes with:
- Spinal Cord Injury (SCI)
- Limb amputations
- Cerebral Palsy
- Blindness/Visual Impairment

Special Olympics
- Athletes with intellectual disabilities

Deaflympics
Paralympic Sports

- Archery
- Basketball
- Boccia
- Curling
- Cycling
- Equestrian
- Fencing
- Judo
- Powerlifting
- Rowing
- Rugby
- Sailing
- Shooting
- Soccer
- Swimming
- Table tennis
- Track and field
- Volleyball
- Wheelchair dance
- Wheelchair rugby
- Alpine skiing
- Boccia
- Cross-country skiing
- Sled hockey

Functional Classification System

- Incorporates
  - Medical information
  - Athletes ability to perform sport specific skills
  - Observation while playing
- Each class identified by
  - Letter (T track, S swimming) followed by a
  - Number
  - Higher number denotes more advanced ability
- Ensure fair competition
- May differ between organizations

Organizations

Table 1

<table>
<thead>
<tr>
<th>Organization</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States Paralympics</td>
<td><a href="http://www.usaparalympics.org">http://www.usaparalympics.org</a></td>
</tr>
<tr>
<td>Dwarf Athletic Association of America</td>
<td><a href="http://www.dasa.org">http://www.dasa.org</a></td>
</tr>
<tr>
<td>National Disability Sports Alliance</td>
<td><a href="http://www.ndspa.org">http://www.ndspa.org</a></td>
</tr>
<tr>
<td>Special Olympics International</td>
<td><a href="http://www.specialolympics.org">http://www.specialolympics.org</a></td>
</tr>
<tr>
<td>USA Beach Sports Federation</td>
<td><a href="http://www.usabhf.org">http://www.usabhf.org</a></td>
</tr>
<tr>
<td>U.S. Association of Blind Athletes</td>
<td><a href="http://www.usaba.org">http://www.usaba.org</a></td>
</tr>
<tr>
<td>Wheelchair Sports (IG)</td>
<td><a href="http://www.wcig.org">http://www.wcig.org</a></td>
</tr>
<tr>
<td>International Paralympic Committee</td>
<td><a href="http://www.paralympic.org">http://www.paralympic.org</a></td>
</tr>
<tr>
<td>Comité International des Sports des Handis</td>
<td><a href="http://www.chs.org">http://www.chs.org</a></td>
</tr>
<tr>
<td>International Blind Sports Association</td>
<td><a href="http://www.ibsa.org">http://www.ibsa.org</a></td>
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* Partial list
Epidemiology

- Data on intellectual disability is limited
- Data on athletes with disabilities is labyrinthine

**Injuries to Athletes With Disabilities**

- Conclude that injury incidence/patterns similar for athletes with and without disabilities
- Soft tissue injuries most common
- Site and type of injury depend on sport/disability
  - UE injuries more common in ambulatory athletes (visually impaired, amputee, CP)
  - LE injuries more common in SCI/wheelchair athletes

Cross-disability study

- Ferrara and colleagues
- 426 athletes
- 32% respondents reported at least 1 “time-loss injury” in past 6 months
Epidemiology

- National Wheelchair Athletic Association (NWAA)
  - 57% involved shoulder and arm/elbow
- United States Association for Blind Athletes (USABA)
  - 53% LE
- United States Cerebral Palsy Athletic Association (USCPAA)
  - Knee (21%)
  - Shoulder (16%)
  - Forearm/wrist (16%)
  - Leg/ankle (15%)

- 3 year LONGITUDINAL cross-disability study (n=319)
- "Athletes with Disabilities Injury Registry"
- Injury rate

<table>
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<th>Table 2. Patterns of Injuries to Disabled Athletes</th>
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<tr>
<td>Study Affiliation</td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>NWAA athletes wheelchair</td>
</tr>
<tr>
<td>Shoulder, arm, elbow</td>
</tr>
<tr>
<td>USCPAA athletes (lower limb)</td>
</tr>
<tr>
<td>Knee</td>
</tr>
<tr>
<td>Forearm and wrist</td>
</tr>
<tr>
<td>Leg/ankle</td>
</tr>
</tbody>
</table>

Epidemiology

- Injury rate:
  - 9.3/1000 athlete exposures
    - (1 athlete participation in 1 practice or game)
  - Rate similar to other able-bodied sports
    - 12-15/1000 college football
    - 9.8/1000 college soccer
    - 7.0/1000 college basketball
Epidemiology

- Injury Severity:
  - 17.02 mean days lost
    - 52% minor injuries (<7 days lost participation)
    - 29% moderate (8-21 days lost)
    - 19% major (22+ days lost)
  - Able-bodied 70/20/10 (Powell)

- Injury Type:
  - 29.8% illness
  - 22.1% muscular strains
  - 9.5% tendinopathy
  - 5.8% sprains
  - 5.6% contusions
  - 5.1% abrasions

- Injury Location:
  - 26.1% LE/23.3% UE
    - 13.3% thorax
    - 12.2% shoulders
    - 12% lower leg/ankle/toes
    - 7.4% hip/thigh
• Prospective epidemiological studies covering sports injuries in disability athletes
  - 7 in last 3 years
  - 8 in previous 22 years
  - Most short duration (during Paralympics, etc)

• 489 articles/15 articles
• Only prospective cohort studies
  - to exclude recall bias

• 10-point quality score
  - Definition
  - Prospective design with incidence/prevalence
  - Description of population or positions
  - 80% of athletes analyzed
  - Info reported to a healthcare professional
  - Same mode of data collection used
  - Diagnosis conducted by doctors
  - 6 months + of follow-up
SYSTEMIC REVIEW
R Weiler Sports Med 2016

• Lack of consistency in reporting across all injury parameters
  • Injury Rates
    - Wide variability across studies
    - Only 2 studies reported IR per 1000 athlete days with 95% CI
  • Injury definition
    - Medical attention (8)
    - Implied medical attention but not defined (2)
    - Time loss >3 day (4)
    - No clear definition (5)

• Similar inconsistency
  • Injury severity (No studies reported)
  • Injury diagnosis
  • Injury by disability classification

Only 3 studies reported both
  • Athlete disability classification
  • Sport-specific functional impairment
    - (Same lead author)

Not possible to draw conclusive findings about epidemiology of injuries in disability sports
  • Heterogeneous nature of publications
  • Variations in study methods
Barriers

• Wide variety of definitions
• Wide variety of disability classifications
  o When disability or classification groups were reported the participant numbers became so low that injury risk conclusions became even more uncertain
  o Difficult to get large sample size/statistically significant research conclusions
• Background data sparse
• Fewer subjects
• Studies focused on short duration of competition
  o (After paralympics, etc.)
  o (Only 2 longitudinal studies over 6 months)
• Minimal exposure analysis
• No analysis of injury severity
  o Difficult to make comparison of injury risk and severity
  o Comparisons of severity within different disability sports and with able-bodied athletes were not possible

Need

• Need for a consensus to be developed
  o Definitions/methods for conducting and reporting epidemiological studies in disability sports
• Would make disability sports injury studies more comparable and open to pooling of data in future
  o Allow for comparison, conclusion and development of prevention strategies

Need

• Criteria for differentiating acute vs. gradual onset sports injury
• Deterioration in an athletes’ existing chronic conditions important factor in disability sports
Standardizing Reporting Parameters

- Disability
- Functional Impairment
- Exposure
- Injury definitions
- Injury coding
- Severity
- Return to fitness criteria following injury

Injuries

- Disabled athletes subject to many of the same injuries/complications as the able-bodied athlete!
- Some specific disability diagnosis lead to increased risk
  - Wheelchair
  - Spinal Cord Injury
  - Major limb loss

Wheelchair Use

- 65% SCI
- 12% polio/postpolio syndrome
- 10% NM and MSK disorders
- 9% congenital disorders
- 3% amputees
Wheelchair Use

- Shoulder
- Elbow
- Wrist

Wheelchair-Shoulder

Increased risk

- Reliant on upper limbs
  - Weight-bearing joint
  - Wheelchair propulsion, transfers, ambulation
  - Relative rest may be impossible
- Upper limb injuries disabling as relied
- Muscle imbalances in shoulder girdle due to weakness
  - Abduction greater than adduction and internal/external rotation
  - Weak scapulothoracic stabilizers
  - Superior placement of humeral head
  - Reduced subacromial space

Most common

- Rotator cuff injury/subacromial bursitis/impingement
- Suprascapular neuropathy at spinoglenoid notch
- Biceps tendinitis
- AC joint, CC ligament thickening, distal clavicle osteolysis
Wheelchair-Shoulder

- Treatment difficult
  - Resting impractical
  - Ice
  - NSAIDs
  - Corticosteroid injection
  - PT
    - Flexibility of anterior shoulder musculature
    - Strengthening adduction, internal/external rotation, scapulothoracic stabilization
  - Wheelchair design/Use of ideal propulsion techniques

Wheelchair-Shoulder

- Despite increases in repetition, wheelchair athletes DO NOT have higher incidence of shoulder pain than nonathletic wheelchair users
- Actually, participation may have protective effect
  - Increased strength/endurance

Wheelchair-Elbow

- Ulnar nerve entrapment
  - 2nd most common UE nerve entrapment syndrome
- No evidence to suggest at greater risk than non-athletes
Wheelchair-Elbow

- Others
  - Medial and lateral epicondylitis
  - Osteoarthritis
  - Olecranon bursitis
- Treatment tailored to individual
  - Non-mobile if required to restrict weight bearing activity

Wheelchair-Wrist

- Carpal tunnel Syndrome
  - #1 most common nerve entrapment
  - Able-bodied and disabled persons
  - 49-73% prevalence in long-term wheelchair users
  - Symptomatic wheelchair users with have lower functional status vs other wheelchair users

- Others
  - Entrapment at Guyon’s canal
  - Osteoarthritis
  - Tendinitis
  - DeQuervain’s tenosynovitis
Spinal Cord Injury

- Thermoregulation
- Autonomic Dysreflexia
- Orthostatic Hypotension
- Acute Motion Sickness
- Spasticity
- Osteoporosis
- Skin Breakdown
- Heterotopic Ossification

Thermoregulation

Following SCI, disruption of neuroregulatory systems involved in control of body temperature
- Paralysis of skeletal muscle
- Loss of autonomic nervous system control below level of injury
  - Lesions above T8
- Exposed to
  - Greater increases in body temperature with exertion
  - Greater increases in temperature with exposure to cold

Cold
- Impaired shivering to produce heat below lesion
  - Impaired vasomotor and autonomic neural control
  - Decreased muscle mass below the lesion
  - Possible impaired central temperature regulating mechanics
- Risk of hypothermia
- Possible particularly concerning
  - Exacerbated by impaired sensation
Thermoregulation

- Heat
  - Impaired sweating and vasodilation/control of peripheral blood flow to dissipate heat below lesion level
  - Less surface area available for evaporative cooling
  - Venous pooling in lower limbs and decreased VR, reducing heat loss by convection and radiation
  - Risk of hyperthermia/heat illness/heat stroke
    - Risk compounded by environment, dehydration, medications
      - Anticholinergics, narcotics, antidepressants, etc.
  - Treatment:
    - Clothing removal
    - Moving to cool environment
    - External cooling, IV fluids

- Prevention
  - Heightened awareness and monitoring
  - Appropriate clothing and equipment
  - Avoidance of extreme temperatures
  - Availability of rehydration

Autonomic Dysreflexia

- Loss of inhibition (unregulated) of the sympathetic nervous system due to interruption of neural pathways after SCI
- Leading to uncontrolled sympathetic response
  - Triggered by a noxious stimulus below the SCI level
  - T6 level and above
  - Mechanism not completely understood
Autonomic Dysreflexia

• Symptoms include:
  o Sweating above the lesion
  o Chest tightness
  o Headache
  o Flushing
  o Paroxysmal hypertension
  o Hyperthermia
  o Cardiac dysrhythmia
  o GI disturbance

• Medical emergency:
  o Can lead to stroke and death

Autonomic Dysreflexia

• Common noxious stimuli below level of lesion can trigger response:
  o Infections/cystitis
  o Urinary retention/bladder distention
  o Renal stones
  o Prolonged peripheral skin pressure/presure ulcers
  o Tight clothing
  o Skeletal stimulation
  o Acute fractures
  o Intra-abdominal pathology
  o Bowel distention
  o Anal fissures

Autonomic Dysreflexia

• Treatment
  o Remove from sport activity!
  o Identify/eliminate precipitating stimuli!
  o Transport to ER!
  o Loosen clothing
  o Sit upright to promote orthostatic decrease in BP
  o Nifedipine/nitropaste (rapid onset) 10mg
    • If BP > 150mmHg
    • Risk of rebound hypotension
Autonomic Dysreflexia

- Prevention
- Counseling athletes
  - Bowel and bladder maintenance
  - Skin care

- “Boosting”/“Doping”
  - Intentional self-induced AD in order to improve athletic performance/competitive advantage
  - Knowingly trigger by self-induced noxious stimulus
  - 16.7% WADA/IPC survey 2009

- “Boosting” common methods
  - Drink large amount of fluid/crimp catheter to over distend bladder
  - Strap legs tightly
  - Sitting on sharp objects
  - Self-induced lower-leg fractures reported
Autonomic Dysreflexia

- Mechanism unknown
- Hypothesis
  - Increased catecholamines
  - Increasing blood flow to working muscle
  - Increased use of adipose, causing glycogen sparing

1994 study of elite quadriplegic athletes
- Boosting vs unboosted
- Boosting reduce race time
  - Statistical analysis on boosted vs unboosted
  - Race time mean improvement of 9.7% (p<0.05)
  - Cardiac output
  - Pulmonary function
  - Muscle twitch
  - Significant higher VO2 max (19.8%) and oxygen utilization

Self-induced dysreflexia poses serious health risks for athlete
- Considered an ergogenic aid
  - Not sanctioned by sports-governing bodies
  - Prohibited international Paralympic Committee (if observed)
  - Systolic >180mmHg hazardous

Say No to Doping
Orthostatic Hypotension

- Caused by
  - Decreased sympathetic efferent activity in vasculature below level of injury
  - Also decreased reflex vasodilatation
  - Resulting in venous pooling in dependent areas that occurs with position change
- Prevention
  - Compression stocking/abdominal binders
  - Maintenance of hydration
  - Salt supplementation
- Pharmacologic treatment
  - Midodrine
  - Fludrocortisone
  - Ephedrine

Acute Motion Sickness

- Winter sports often at altitude
- Alteration in BBB and cerebral vasculature at altitude
- SCI higher risk
  - Already with altered neurophysiology and anatomy
- Acetazolamide prophylaxis
- Treatment
  - Return to altitude!
  - Acetazolamide
  - Dexamethasone

Spasticity

- Velocity dependent increase in muscle tone occurring after and injury to upper motor neurons
- Common complications of SCI
- Treatment
  - Oral medication
  - Injectables
  - Intrathecal medications
  - Surgery (tendon lengthening)
Osteoporosis

- Increased risk in SCI
- Increased fracture risk
  - Confounded by impaired sensation
- Etiology unclear
  - Disuse/decreased weight-bearing
  - Neural factors with area below lesion level experiencing increased demineralization
- Treatment/Prevention
  - Mechanical stimulus to LE bones
  - Early weight-bearing with assisted standing
  - Calcium, vitamin D supplementation, bisphosphonates, calcitonin

Skin Breakdown

- Pressure ulcers significant M&M
- Insensate skin increases risk of breakdown
- Prolonged pressure resulting in disruption
  - Sacrum, coccyx, ischial tuberosity
- Sport/event specific
  - Athletic wheelchair sacrifices pressure relief for higher performance
    - Knees higher than buttocks further increase risk
    - Medial arm/forearm

Skin Breakdown

- Treatment
  - Vigilant/careful monitoring
    - Especially while transitioning to new equipment
  - Weight shifts to relieve pressure
  - Padding
  - Bi-occlusive dressing
  - Electrical stimulation to increase blood flow
  - Modify/restrict activity to prevent further injury
Neurogenic Bladder
• Bladder dysfunction risk for:
  o Infection
  o Incomplete voiding
  o Elevated intra vesical pressure
  o Catheter use
• Typical signs/symptoms absent
  o Increased spasticity
  o Malaise
  o Lethargy
  o Sense of unease with movement
• Antibiotics required if symptomatic
• Routine antibiotics not recommended if asymptomatic
  o Increase risk of drug resistance, as commonly have bacteruria

Major Limb Loss
• Skin Complications
• Heterotopic Ossification
• Neuroma

Skin
• Becomes weight-bearing surface
• Increased risk for breakdown
• May occur when pressure applied disproportionately
• Risk compounded by impaired sensation in residual limp, and sweating with sport increases moisture at skin-socket interface, making skin breakdown more likely
• Can be very disabling
**Skin**

- Verrucous hyperplasia
  - Wart-like lesion at distal end of stump
  - Results from proximal residual limb constriction from a socket or wrap, causing decreased pressure in the distal residual stump
- Prevented by equal distribution of pressure throughout the entire circumferential surface of the residual limb (total contact socket)
- In addition
  - Silicone liners, padded sleeves, socks, and additional padding

**Heterotopic Ossification**

- Bone formation in tissue that not normally ossified
- Seen in TBI, SCI, burns, total arthroplasty
- High rates in residual limb of traumatic amputee
  - Not necessarily in vicinity of joint
- Pain and increased risk skin breakdown
- Treatment
  - Early recognition
  - Modification of prosthetic socket to accommodate ectopic bone
  - Increased monitoring skin breakdown
  - Surgical excision may be required

**Neuroma**

- Occurs at distal end of resected nerve in residual limb of amputee
- When exposed to pressure, creates parasthesias and radiating pain in phantom distribution of the resected nerve
- Can create disabling pain with weight-bearing
- Treatment
  - Prosthetic modification to relieve pressure
  - Oral medications (TCA/anti-epileptic)
  - Cortisone/local anesthetic injections
  - Surgical excision may be required
Athletes with Intellectual Disabilities

- Special Olympics
  - Down Syndrome
  - Autism
  - Asperger Syndrome
  - Fragile X

Athletes with Intellectual Disabilities

- Down Syndrome
  - Visual screening
  - Careful H&P
  - Echocardiogram
    - ASD, VSD
  - Lateral radiograph of the C-spine in flexion/neutral/extension

Athletes with Intellectual Disabilities

- Visual screening
- Careful H&P
- Echocardiogram
- ASD, VSD
- Lateral radiograph of the C-spine in flexion/neutral/extension
Atlantoaxial instability

- Increased mobility of 1st and 2nd cervical vertebrae
- 15% of persons with Down Syndrome
- Usually asymptomatic
- Yearly screening controversial
- Separation of odontoid and atlas > 4-5mm on lateral radiograph suggests instability

Atlantoaxial instability

- Restricted from sport requiring excessive neck flexion/extension
  - Contact/collision sports
  - Gymnastics
  - Diving
  - Pentathlon
  - Butterfly stroke
  - High jump
  - Heading in soccer
  - Diving starts in swimming
  - Certain warm-up exercises that involve neck flexion-extension

Blind Athletes

- Proprioception worse than with partial vision
- Abnormal gait/biomechanics
- LE most affected
  - Overuse injuries
  - Ankle sprains
  - Contusions
- Treatment same
- Prevention
  - Familiarize athlete with environments
  - Adequate guidance/support
Pre-participation Assessment

• Upon entry into sports
  o At least every 2-3 years
• Systematic and comprehensive
• Medical team approach
  o Longitudinal care
  o Knowledge of baseline functioning
  o Avoid mass screening
• Do NOT overly focus on athlete’s impairment/disability and miss common medical issues
• Careful evaluation (prior to competition) of athlete’s
  o Wheelchair
  o Prosthetics
  o Orthotics
  o Assistive/adaptive devices

Pre-participation Assessment

• History
  o Goals
  o Level of training
  o Participation
  o Medications/supplements
  o Impairments
  o CV/Pulm history
  o Level of functional independence
  o Needs for adaptive equipment

Pre-participation Assessment

• Medications
  o Thermoregulation
    • Adversely affected by sympathomimetics and anticholinergics
  o Volume depletion and dehydration
    • Potential problem with diuretics and excessive caffeine
Pre-participation Assessment

- Exam
  - Sensory deficits, neurologic deficits
  - Joint stability and ROM, muscle strength, flexibility, skin integrity
  - Wheelchair stability, strength of common injured sites and trunk
  - Amputate stability, strength of trunk, as well as hip girdle
  - Skin breakdown in insensitive pressure areas and sites in contact with prosthesis

Summary

- These athletes are amazing!
- Understand terminology
- Identify risk factors/common injuries
- Consider injury prevention strategies
- Identify areas of improvement

Most Pressing Reporting Issues

- Lack of conformity on sports injury definitions
- Lack of consensus on methodology and reporting for disabled sports studies
- Disability and impairment descriptor reporting omissions
- Focus on short-term competition-based studies
- Lack of long-term follow-up
- Athlete baseline data rarely being collected
- Consistency of exposure reporting and injury severity not being reported
The End

Do not let what you can not do interfere with what you can do.

John Wooden

Resources

• Five Year Overview of Sport Injuries: The NAIRS Model. W Buckley, JOPERD-June 1982.