



Supporting Function through Adaptive Fitness and Sport

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Objectives

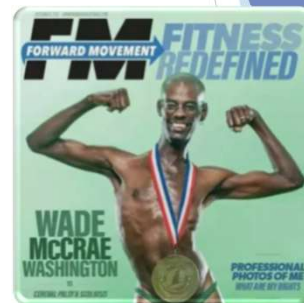
- ▶ Review common medical considerations of physical activity in those with congenital and acquired disability
- ▶ Review the benefits of physical activity and sport for individuals with disability

No financial disclosures



Disability ≠ Inability

- ▶ Running
- ▶ Cycling
- ▶ Golf
- ▶ Wheelchair
 - Basketball
 - Rugby
 - Power Soccer
 - Softball
 - Dance
 - Fencing
 - Curling
 - Tennis and Table tennis
- ▶ Volleyball
- ▶ Water Sports
- ▶ Sled Hockey
- ▶ Alpine Skiing/Snowboarding
- ▶ Throwing sports
 - Discuss, Javelin, Shot put, Boccia
- ▶ Shooting Sports
 - Archery, air rifle, trapshooting
- ▶ Weightlifting
- ▶ Combat Sports
 - Judo, boxing, wrestling, MMA
- ▶ Extreme Sports
- ▶ Rock Climbing



Sports for Athletes with VI

IBSA
INTERNATIONAL
BLIND
SPORTS
FEDERATION

USABA
THE UNITED STATES ASSOCIATION OF BLIND ATHLETES

- ▶ Athletics
- ▶ Football (soccer)
- ▶ Goalball/Torball
- ▶ Table Tennis/Polybat
- ▶ Judo
- ▶ Bowling
- ▶ Powerlifting
- ▶ Shooting/Archery
- ▶ Swimming
- ▶ Baseball
- ▶ Golf
- ▶ Rowing
- ▶ Cycling
- ▶ Skiing



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Adaptive Sports Medicine

- ▶ Prevention, diagnosis, and management of **disability-related** health complications that occurs with sports and physical activity participation
 - Clinical service delivery
 - Scholarly discipline
 - Advocacy

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Pre-Participation Physical

- ▶ Completed six weeks prior to competition
- ▶ History should include:
 - Pre-disability function
 - Present level of training
 - Current medications and supplements used
 - Presence of impairments
 - Level of functional independence for mobility and self-care
 - History of prior sports participation history of injuries
 - Need for adaptive equipment
- ▶ Special Attention:
 - Sensory deficits
 - Temperature intolerance
 - Neurologic impairment
 - Joint stability/Range of motion
 - Muscle strength
 - Skin integrity
 - Athlete-equipment interface



Autonomic Dysreflexia

- ▶ Unregulated sympathetic outflow due to spinal cord injury at or above T6
- ▶ Triggered by noxious stimuli (pain) below the level of injury
- ▶ Symptoms: headache, skin flushing, goosebumps, and diaphoresis
- ▶ Requires immediate attention:
 - Sit upright, have restrictive clothing removed, search for the source of noxious stimuli
- ▶ “Boosting”: Utilizing autonomic dysreflexia as a performance aid (massive adrenaline release)
 - Banned and screenings at competitions



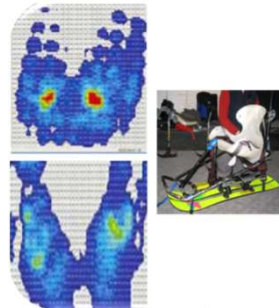
Temperature Regulation

- ▶ Risk of both hypothermia and hyperthermia
- ▶ Loss of motor/sensory function + lack of control of autonomic function
 - ▶ Inability to sweat or shiver below the level of injury
- ▶ Degree of impairment is directly related to the level of SCI



Skin

- ▶ Prolonged pressure over bony prominences combined with shearing forces from activity on moist/insensate skin can cause local tissue ischemia and injury
- ▶ Current pressure injury is a contraindication to sport participation
- ▶ Prevention: appropriate fit, frequent skin checks, weight relief every 15 minutes, appropriately fitting seat cushions, and maintenance of a dry environment



Cardiovascular

- ▶ Congenital heart defects
 - Up to 50% of those with a birth/genetic difference have a difference in heart structure/function
 - Cardiac stress test and echo should be considered

- ▶ Lower blood pressure
 - When changing positions (orthostatic hypotension)
 - Blood vessels aren't as tight below level of injury (Regularly seen in SCI)
 - Prevention includes: lower limb compression stockings, abdominal binders, staying hydrated, and increasing salt intake



Motor Control Impairment

- ▶ Spasticity, dystonia, ataxia, athetosis
 - Some spasticity can be helpful

- ▶ Impaired coordination of muscles

- ▶ Specific patterns of muscle imbalance can predispose to:
 - Injury
 - Overuse syndrome
 - Muscle strains



Nerve Compression

- ▶ Median mononeuropathy at the wrist (Carpal Tunnel)
 - Greater than 50% prevalence in WC athletes
 - Due to increased pressure on the wrist bones
 - Looser grip may help

- ▶ Ulnar mononeuropathy at the wrist (Guyon's canal)
 - Weight lifting, racquet sports, WC propulsion
 - Counter force braces, proper technique and appropriately tensioned rackets



Limb Deficiency

- ▶ Complex biomechanical analysis
- ▶ Common skin issues
- ▶ Attention to proper socket fitting, use of silicone liners, padded sleeves, socks, and appropriately placed padding
- ▶ Neuroma/Pain in the residual limb
 - Pressure relief, pain medicines, corticosteroid injection, or surgical excision

- ▶ Abnormal bone growth:
 - Heterotopic ossification
 - Terminal overgrowth

- ▶ Increased impact from compensation for imbalances
 - UE amputee: secondary neck and upper back spine injuries
 - LE amputee: secondary low back pain, intact limb overuse injuries



Musculoskeletal

- ▶ Pediatric: immature skeletal system, growth
- ▶ Altered forces at the hip can cause malformation
 - Acetabular dysplasia, hip subluxation/dislocation
- ▶ Neck (Atlantoaxial) instability
 - Roughly 15% in Down Syndrome
 - Greatest risk is between 5 and 10 years of age
- ▶ High prevalence of foot deformities
- ▶ Joint laxity: Predisposes to subluxation/dislocation, muscle, tendon, and ligament injury



Nutrition

- ▶ Altered nutrition requirements
 - Overweight/Underweight
- ▶ Relative energy availability
 - Effects on hormone regulation (reproductive hormones, glucose metabolism, etc)
- ▶ High prevalence of decreased bone density
 - Requires screening before participation in contact sports



Athlete/Technology Interface

- ▶ Transtibial/transfemoral running prostheses
- ▶ Adaptive cycling prostheses
- ▶ Adaptive golfing prosthesis
- ▶ Standing/seated alpine or cross-country skiing equipment
- ▶ Snowboarding prostheses
- ▶ Swimming prostheses
- ▶ Kayaking terminal devices
- ▶ Terminal rock pick and suspension systems for rock climbing



Biomechanics of Injury

- ▶ Lack entirety of kinetic chain
 - Greater force on tissues
 - Bat, club, and racket sports
- ▶ Wheelchair: shoulder becomes the weight bearing joint of the body
 - Tendency to internally rotate due to pull of pectoralis
 - Abnormal position and movement of shoulder blade
 - 300% increase in vertical force into the shoulder
 - Akbar 2015: Overhead sports are additive risk



▶ Posture:

- Posterior pelvic tilt, increased forward bend of the spine (kyphosis), protracted neck
- 59% of shoulder pain is referred from neck



Implications of Injury



- ▶ Musculoskeletal injuries may have a greater functional consequence in the lives of athletes with disabilities compared with the general athletic population (Blauwet 2012)
- ▶ Complete vs relative rest
 - Propulsion and transfers may recruit ~50% of maximal strength (Serra-Ano 2012)
- ▶ Must consider the impact of injury on participation as well as activities of daily living
 - Special accommodations, equipment, and assistance are needed
- ▶ No consensus on rehabilitation protocol in this population



Injury Rates

- ▶ SCI athletes had a significantly higher prevalence of fractures compared with other athletes (Patatoukas 2011)
 - ▶ 52% of injuries resulted in 7 days lost or less, 29% in 8 to 21 days lost and 19% in greater than 22 days lost (Webborn 2006)
 - ▶ Injury rate of 9.3 injuries per 1000 elite athlete-exposures (AE)
 - American football 10.1 to 15/1000 AE
 - Soccer 9.8/1000 AE
 - Basketball 7.0/1000 AE (Ferrara 2000).
- Fagher 2014:
- ▶ Summer Paralympics Games 2012 - 17.8 injuries/100 athletes (Willick 2013)
 - ▶ Summer Olympic Games 2012 - 12.9 injuries/100 athletes (Engebreetsen 2013)
 - ▶ In elite adaptive athletes training/overuse injuries account for >50% of injuries
 - ▶ Common acute injuries: Sprains (32%), fractures (21%), and strains and lacerations (14%)
 - ▶ Highest risk sports are cycling, basketball, rugby



Population in Need

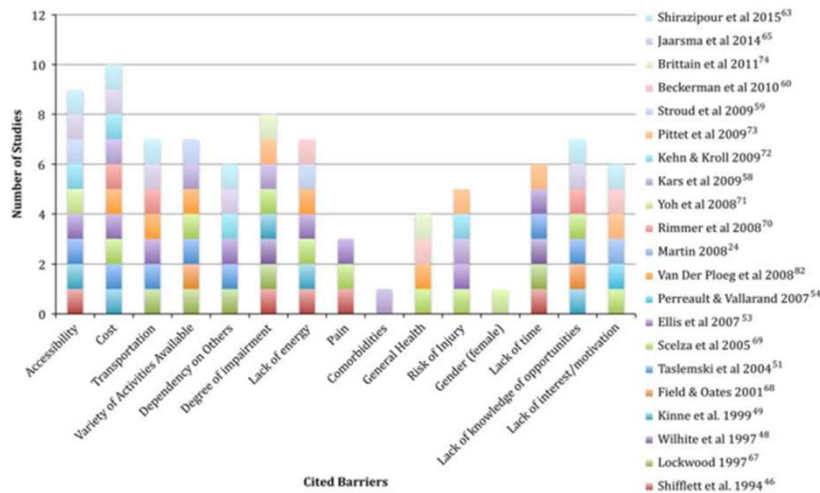
- ▶ U.S. Department of Health and Human Services 2010:
 - 8.9% of children with disability ages 6-19 with meet basic guidelines for physical activity
 - 31% of children (ages 4-11) with disability were reported to be sad, unhappy, or depressed
 - Largely excluded from athletics in public schools (US Government Accountability Office 2010)
 - 51% - 54% with disabilities participated in ZERO leisure time PA (compared to 32% - 38%)
 - Disproportionate rates of chronic diseases: obesity, diabetes, and cardiovascular disease (Osorio 2017)

- ▶ Children and adults with cerebral palsy:
 - 76-99% of their waking hours being sedentary (Verschuren 2017)
 - 13% to 53% less habitual physical activity than their peers (Carlton 2013)

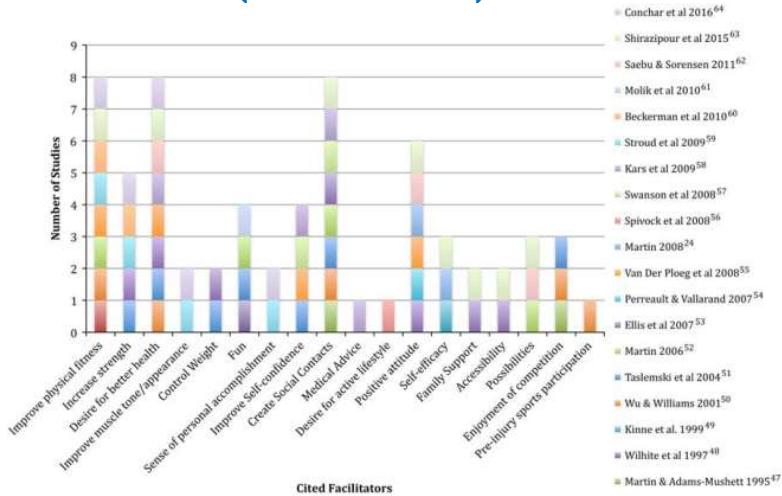
- ▶ Employment Rates:
 - 28.7% with a physical disability, 18.3% in wheelchair users
 - 72.8% in overall population



Barriers (Diaz 2019)



Facilitators (Diaz 2019)



Benefit of Adaptive Activities/Sport

- ▶ Improves metabolic profile: body fat, lean muscle, blood pressure, heart rate, lipid profile, bone density
 - *Fuchs 2001, Hernalahti 2004, Kelly 2004, Macdonald 2007, Kaufman 2007*
- ▶ Mental Health and Quality of Life: Improves self-esteem, self-perceived quality of life, self-efficacy, body image, empowerment, social integration, school performance, motivation for continued involvement, reduces depression and detrimental effects of disability on mental health
 - *Sherrill 1990, Campbell 1994, Paclerek 1994, Martin 1999, Wetterhahn 2002, Yazicioglu 2007, Tasiemski 2005, Spornor 2009, Muraki 2000, Geacobb 2008, Groff 2009, Zwinkles 2015, Côté-Leclerc 2017, Zwinkles 2018*
- ▶ Improves physical profile across wide range of disabilities: strength, endurance, flexibility, gait efficiency, gait mechanics, wheelchair propulsion
 - *Damiano 1995, MacPhail 1995, Damiano 1998, Anderson 2001, Liusuwan 2007, Houghton 2012, Jansen 2013, Oliveira 2014, Rowland 2015, Lewelt 2015, Zwinkles 2013, Ross 2017*
- ▶ Participation improves likelihood of employment in working age
 - *Sports and Employment among Americans with Disabilities, US Department of Labor 2009*
 - *Lastuka 2015*



CMH Adaptive Sports Medicine Clinic

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- ▶ Pre-school age through young adulthood
- ▶ Disability specific pre-participation physicals
- ▶ Acute and chronic management of musculoskeletal pathology:
 - Medicinal prescription/management
 - Physical therapy prescriptions
 - Physical activity and home exercise instruction
 - Training and performance enhancement programs
 - Ultrasound guided musculoskeletal and botulinum toxin injections
 - Acupuncture
- ▶ Adaptive equipment and assistive device evaluation and prescription
- ▶ Longitudinal management of Rehab issues in the adaptive athlete
- ▶ Utilization and incorporation of 3D motion analysis



COVID: All Clear ≠ All Clear

- ▶ Return-to-Play considerations:
 - What state and local authorities will allow
 - What public health agencies recommend
 - Liabilities
 - What participants/parents are willing to accept
- ▶ Stay at home: Virtual opportunities
 - #adaptathome
- ▶ Small groups: social distancing, no sharing of equipment, screen training partners
- ▶ Larger groups: some contact ok with added attention to hygiene, separation of groups
- ▶ Vaccine/Cure developed:
 - No restrictions, continue general infection control
- ▶ Promote behaviors that reduce spread:
 - Staying home when sick
 - Healthy hygiene
 - Face coverings (not recommended/feasible during play)
 - Adequate supplies
 - Posting signs and messaging
- ▶ Healthy Environment/Operations:
 - Sanitation, social distancing, limiting contact, modifying communal spaces
 - Added precautions for higher risk populations - virtual coaching, drills, activities
 - System in place to manage/communicate regarding potential COVID exposures
 - Spectator modifications
 - Travel modifications



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