

Injury Prevention in Paralympic Athletes:

An epidemiological review of unintentional and intentional injuries



Yetsa A. Tuakli-Wosornu, MD, MPH

Assistant Clinical Professor, Yale School of Public Health

Associate Physiatrist, Yale Department of Orthopaedics and Rehabilitation

IOC Working Group for the Prevention of Harassment and Abuse in Sport

IPC Welfare Officer and Medical Committee Member, 2014-18



Outline



*Describe the
Contemporary
Paralympic
Movement*

*Epidemiology of
Unintentional and
Intentional
Injuries*

*On-going Gaps in
Knowledge and
Prevention
Preparedness*

Outline



*Describe the
Contemporary
Paralympic
Movement*

*Epidemiology of
Unintentional and
Intentional
Injuries*

*On-going Gaps in
Knowledge and
Preparedness*

Language and culture are interdependent



One is a reflection of the other and language often reflects long-held but evolving societal beliefs

Language used to describe sport for persons with impairment has evolved

Disabled

/dis ' ab(e)ld/

adjective

(of a person) having a physical or mental condition that limits movements, senses or activities

Synonyms: handicapped, incapacitated

Adapt(ed)

/a ' dapt ' ed/

adjective

(something) made suitable for a new use or purpose; modified; adjusted to new conditions

Synonyms: modified, altered, changed, adjusted, converted, redesigned, reshaped, revamped, rejigged, redone

In 2016, 'Para' was put forth by the IPC as the preferred terminology (2016)

Para

/ 'pera/

prefix

- Beside (Greek); adjacent to

- Distinct from but analogous to

- In combinations often meaning amiss, irregular and denoting alteration or modification

Seminar Questions:

1. Rebecca's dog Dilly (an 8 month old Chihuahua) is missing and she decided to put up posters in her area offering anyone who finds her dog, a reward of £50.

This morning whilst jogging in Hyde Park, Bill sees the poster and phones Rebecca, as last night on his way home from work, he found the dog hiding under a bench on the street.

What type of contract is this and can Bill claim the reward of £50?

2. X and Y promised each other to pay Z. Y dies. Can Y's executors be sued by Z?

Learning Outcomes:

- Be able to explain what is "consideration" and its importance in contract law;
- Show knowledge and understanding of unilateral and bilateral contracts;
- Show awareness of intention to create legal relations;
- Become familiar with contract law terminology;
- Apply legal principles to given facts and demonstrate criticality & analysis when answering fact based questions; and
- Analyse case law and be able to apply case law in a persuasive manner to hypothetical case studies.

The difference between 'Para' and 'Adapted'



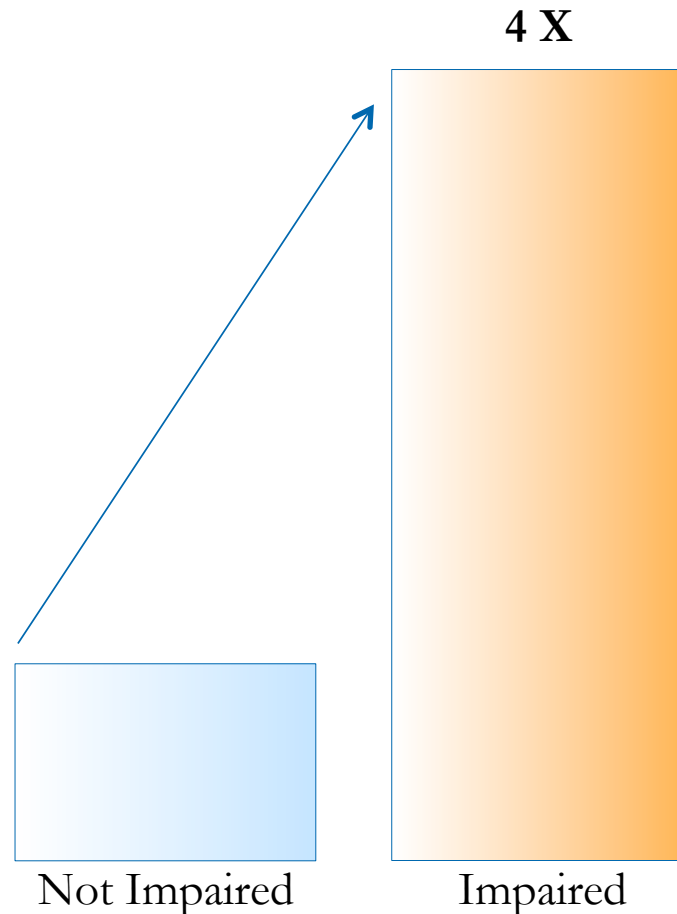
Sport that has been modified or adapted from its original form i.e. wheelchair basketball, wheelchair tennis



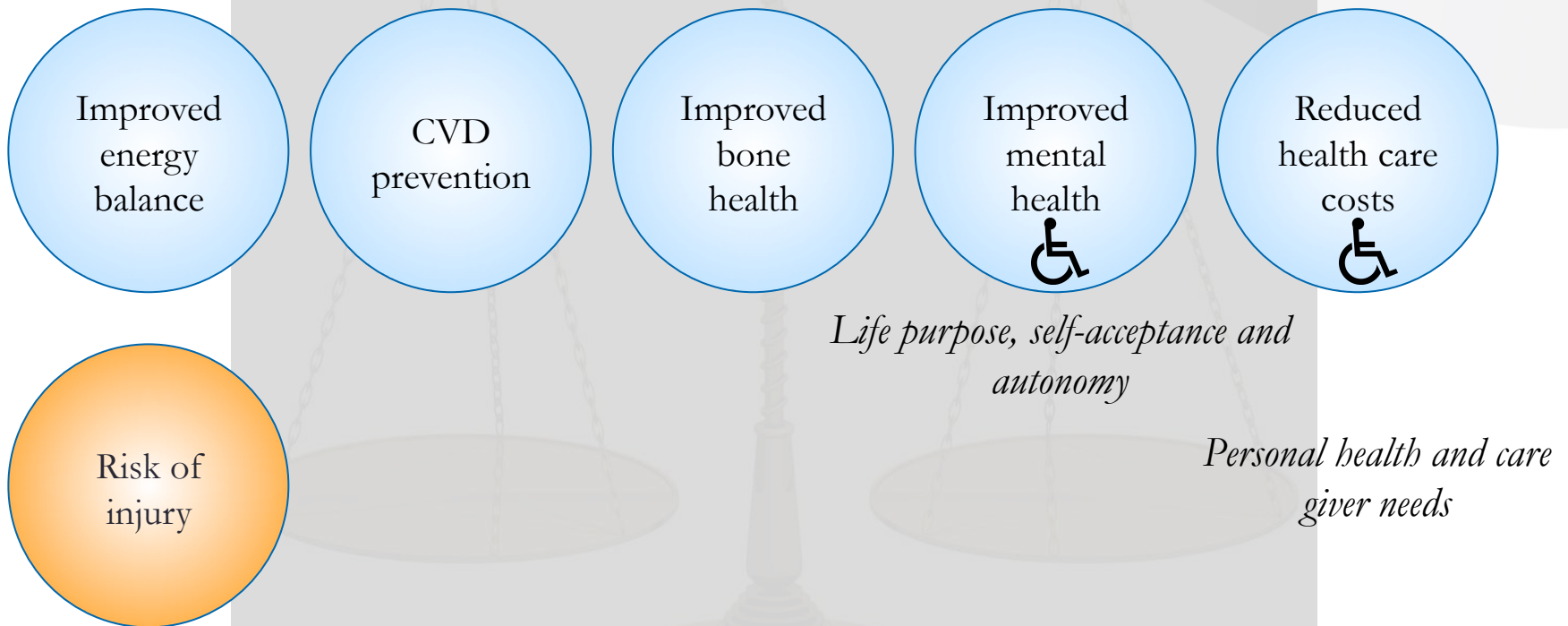
All independent, self-governing sports for persons with impairment, whether or not an able-bodied equivalent exists

Sports represent a critical health strategy for persons with impairment

Risk of lifestyle-related disease



Benefits are well-documented (in contrast to the risks)



Heath GW, Parra DC, Sarmiento OL, et al. Evidence-based intervention in physical activity: lessons from around the world. *Lancet*. 2012;380(9838):272-281.

Sallis JF, Bull F, Guthold R, et al. Progress in physical activity over the Olympic quadrennium. *Lancet*. 2016;388(10051):1325-1336.

Li R, Sit CHP, Yu JJ, et al. Correlates of physical activity in children and adolescents with physical disabilities: A systematic review. *Prev Med*. 2016;89:184-193.

Images: wikimedia.com

Para Rowing is one of 23 Paralympic sports



Eligible impairment categories:

- Impaired muscle power
- Atheotosis
- Impaired passive ROM
- Hypertonia
- Limb deficiency
- Ataxia
- Visual impairment

Features of the sport:

Debuted at the 2008 Games.
There are 4 boat classes, and in the all events, races were 1,000m (now 2K). The equipment (boat, etc.) is adapted to the athletes.

No. of competitors at the Rio Games: 88

Governing body: World Rowing

Our lab attempts to help fill injury-related research gaps in Para sport science

| <u>Study Design</u> | <u>Topic</u> | <u>Outcome(s)</u> |
|-------------------------|---|--|
| Pre- Post- survey | More than just a Game: Using Sport to Promote Social Inclusion and Disability Awareness at Yale | Yale athletes' (+/- students') implicit and explicit attitudes towards athletes with disabilities |
| Secondary data analysis | Sport-related Injuries In Elite Para Powerlifters: A Prospective Analysis Of 1410 Athlete-days At The Rio 2016 Summer Paralympic Games | Sport-related injury incidence rate and injury proportion during the 7 day competition period at the 2016 Paralympic Games |
| Review | Acute and Chronic Musculoskeletal Injury in Para Sport: A Critical Review | Summary of global musculoskeletal injury epidemiology data |
| Case report | A Low-Cost, High-Quality Wheelchair Training Roller for Athletes with Impairment in Low-Resource Settings: Concept Design for Manufacture | Prototype design for manufacture |
| Review | Intentional Injury in Para Athletes: A State-of-the-art Review | Summary of global harassment and abuse epidemiology data |

Outline



*Primer on the
Contemporary
Paralympic
Movement*

*Epidemiology of
Unintentional and
Intentional
Injuries*

*On-going Gaps in
Knowledge and
Preparedness*

Acute and Chronic Musculoskeletal Injury in Para Sport: A Critical Review



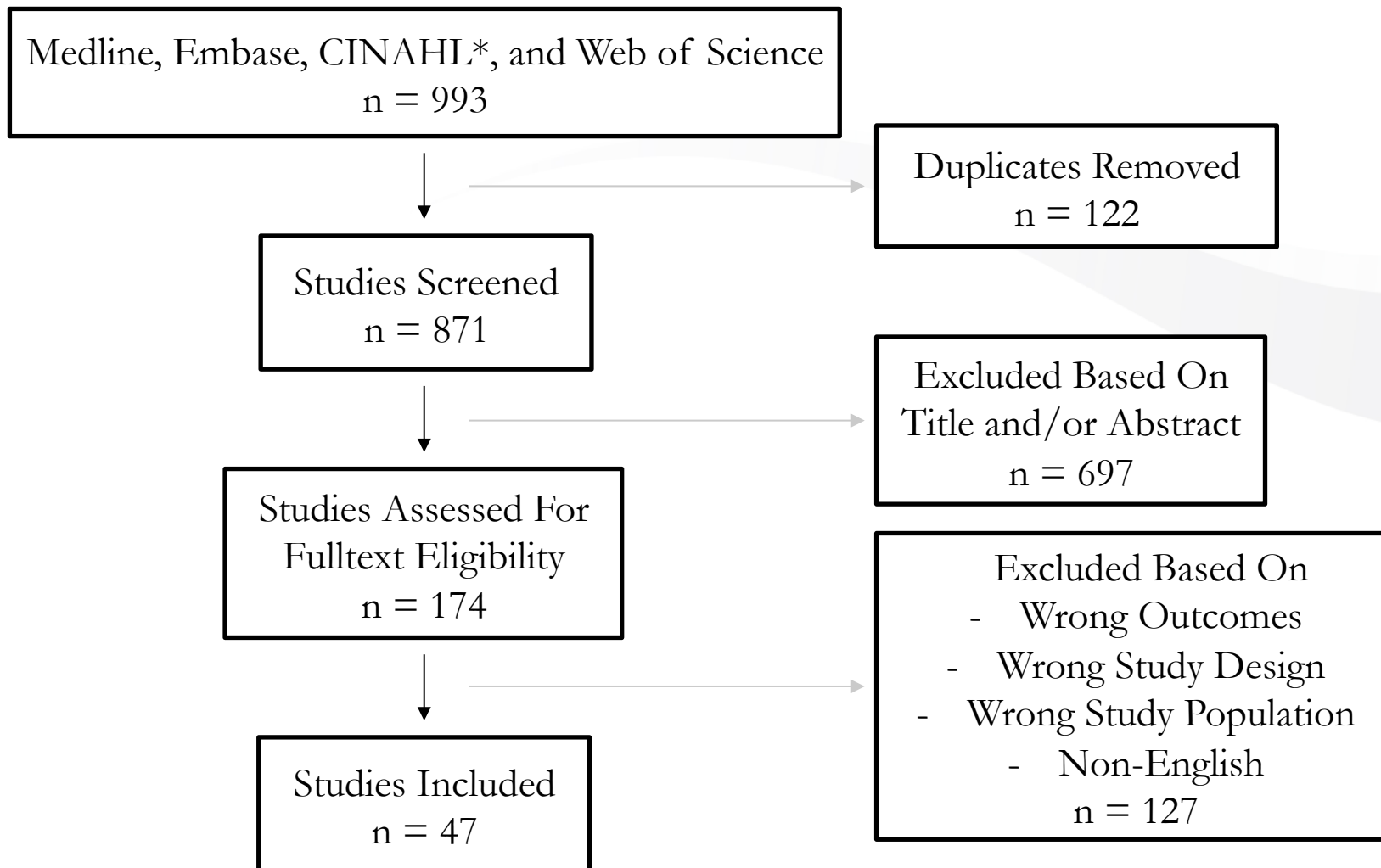
Yetsa A. Tuakli-Wosornu, MD, MPH^{a,*},
Evgeny Mashkovskiy, MD, PhD^b, Taylor Ottesen, BS^c,
Mark Gentry, MA, MLS^d, Daniel Jensen, DPT^e,
Nick Webborn, MB BS, FFSEM, MSc^f

KEYWORDS

- Injury epidemiology • Musculoskeletal injury • Paralympic sport • Para athlete
- Review

Phys Med Rehabil Clin N Am 29 (2018) 205–243
<https://doi.org/10.1016/j.pmr.2018.01.014>
1047-9651/18/© 2018 Elsevier Inc. All rights reserved.

pmr.theclinics.com

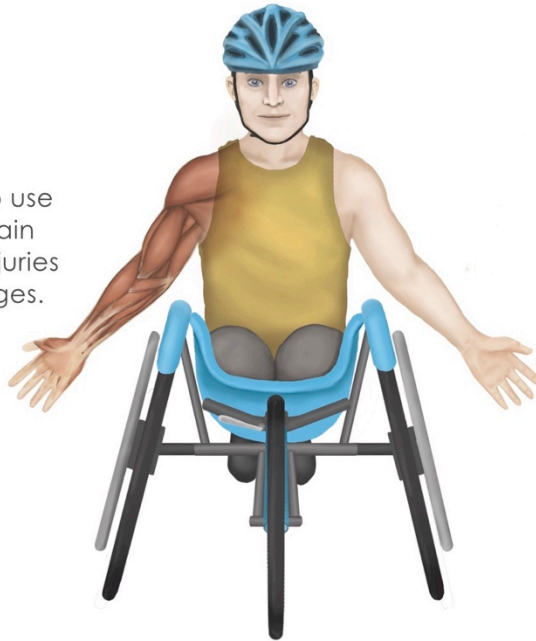


Summary of search results

*Cumulative Index to Nursing and Allied Health

General injury trends in summer and winter Para sports

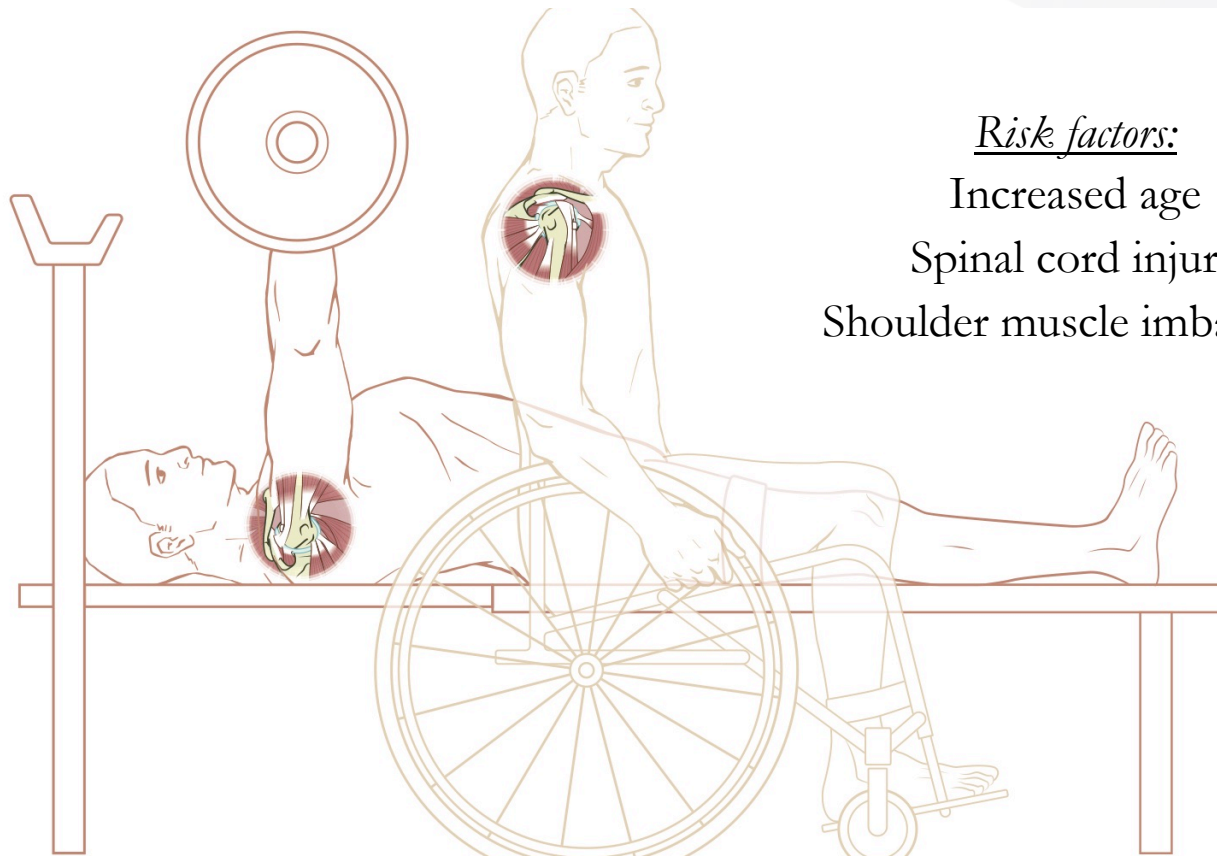
Para athletes who use wheelchairs sustain upper extremity injuries in high percentages.



Ambulant Para athletes sustain lower extremity injuries in high percentages.



In contrast to able-bodied athletes, the upper extremity is the most commonly injured anatomic area



Risk factors:

Increased age

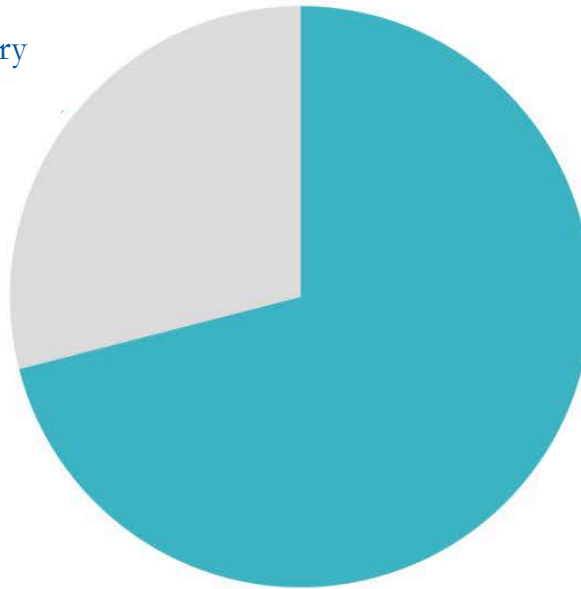
Spinal cord injury

Shoulder muscle imbalance

Injury severity and chronicity

*Acute traumatic injuries /
Catastrophic injuries*

Bone fractures
Traumatic brain injury
Ligament ruptures
Tendon tear



*Chronic overuse injuries /
Minor injuries*

Tendon degeneration
Muscle contusions
Skin abrasions
Sunburn
Decubitus ulcers

Differences in injury epidemiology based on gender and pre-participation behaviors

Male and female summer Para athletes typically have similar overall injury rates

Mandatory periodic health evaluations may result in reduced overall injury rates, and improved performances

Polish scientists compared health practices *before* and *after* the London 2012 and Rio 2016 Games

Injury risk varies by sport and season

Overall injury incidence rate at the Sochi 2014 winter games was 2 X higher than the IIR at the London summer games



During the summer Paralympic Games, the highest incidence of injury was reported in Football 5-a-side, where lower extremity injuries predominated.



During the winter Paralympic Games, the highest injury incidence was reported in the Para Alpine Skiing/Snowboarding category. Among **all** winter sports, upper and lower extremity injuries occurred with similar frequency.

In contrast to non-disabled athletes, seated athletes use the shoulder as a weight-bearing joint

Traditional shoulder

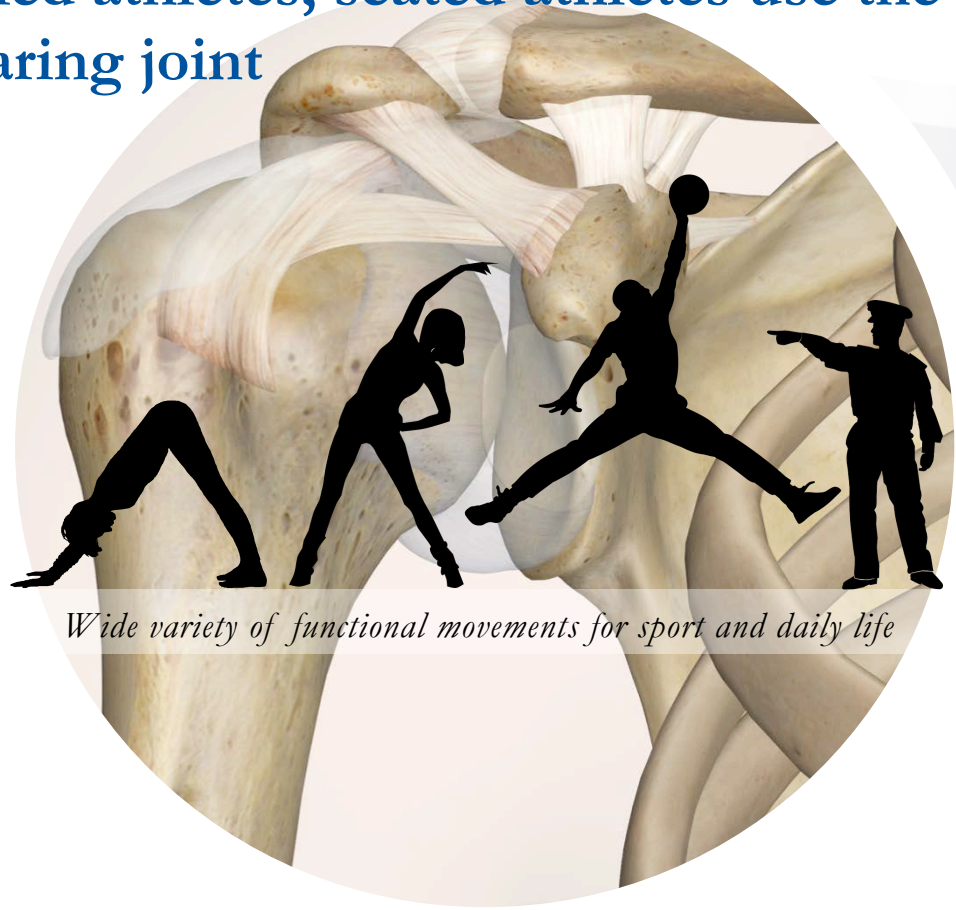
Non weight bearing

Increased degrees of freedom

Multiple planes of motion

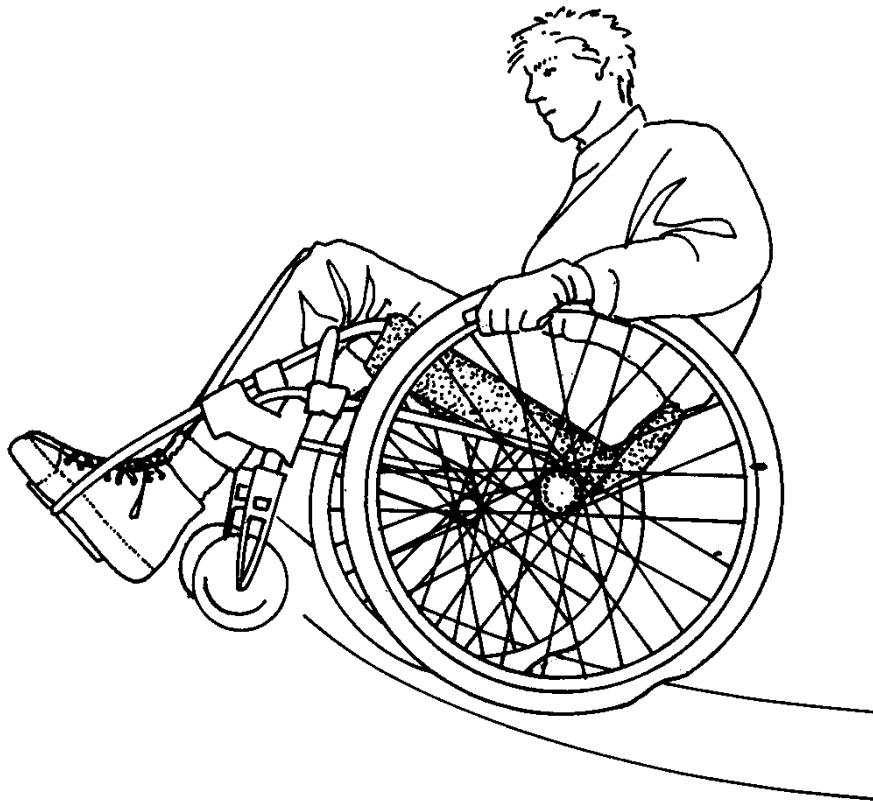
Decreased stability

High risk of overuse injury



Wide variety of functional movements for sport and daily life

Athletes who are daily manual wheelchair users place shoulders under abnormally high loads



Weight shifts

Pressure relief lifts

Transfers

Propulsion

Start/stop maneuvers

*Implications for decisions
around conservative vs.
aggressive treatment?*

Somewhat surprisingly, there is a dearth of data related to overuse injuries (shoulder or otherwise) in Para rowers

2018

J Appl Physiol 124: 805–811, 2018.

First published November 30, 2017; doi:10.1152/jappphysiol.00870.2017.

RESEARCH ARTICLE | *Case Studies in Physiology*

Exercise-induced diaphragm fatigue in a Paralympic champion rower with spinal cord injury

 **Nicholas B. Tiller**^{1,2}, **Thomas R. Aggar**², **Christopher R. West**^{2,4} and **Lee M. Romer**^{2,3}

¹Academy of Sport and Physical Activity, Faculty of Health and Wellbeing, Sheffield Hallam University, Sheffield, United Kingdom; ²Centre for Human Performance, Exercise and Rehabilitation, College of Health and Life Sciences, Brunel University London, Uxbridge, United Kingdom; ³Division of Sport, Health and Exercise Sciences, Department of Life Sciences, Brunel University London, Uxbridge, United Kingdom; and ⁴ICORD, Vancouver, British Columbia, Canada

2011

Rib stress fracture in a male adaptive rower from the arms and shoulders sport class: case report

**Tomislav Smoljanović¹,
Ivan Bojanić¹, Courtney L.
Pollock², Radovan Radonić³**

¹Department of Orthopaedic Surgery, University Hospital Center Zagreb, School of Medicine, University of Zagreb, Zagreb, Croatia

Somewhat surprisingly, there is a dearth of data related to overuse injuries (shoulder or otherwise) in Para rowers

Para sailing and rowing

Overuse rib stress injury was reported in a single Croatian Para athlete, and authors speculate that this unique injury is potentially due to complete reliance on the upper extremity and torso in certain classes of high-level spinally injured rowers, in addition to high force transmission through certain areas of the body during rowing.⁷⁷⁻⁷⁹

Outline



*Primer on the
Contemporary
Paralympic
Movement*

*Epidemiology of
Unintentional and
Intentional
Injuries*

*On-going Gaps in
Knowledge and
Preparedness*

FISA and other international sport organizations are increasingly recognizing the importance of Safe Sport

Safe Sport:

An athletic environment that is free from all forms of harassment and abuse

International Olympic Committee. IOC Launches Toolkit For Olympic Movement to Safeguard Athletes from Harassment and Abuse in Sport. <https://www.olympic.org/news/ioc-launches-toolkit-for-olympic-movement-to-safeguard-athletes-from-harassment-and-abuse-in-sport> Accessed August 20, 2018.

Brackenridge C, Kirby S. Playing Safe: Assessing the risk of sexual abuse to elite child athletes. *Int Rev Sociol Sport* 1997;32(4):407-18.

Kirby SL, Kerr GA. Safe Sport Canada Presentation to the Federal Government. August 3, 2018

Sylvie P, Guylaine D. Sexual abuse in sport: a model to prevent and protect athletes. *Child Abuse Rev* 2011;20(2):120-33.

Safe Sport International. Challenging Violence in Sport: Safe Sport International Conference. Madrid, Spain: April 6-7, 2018.

FISA and other international sport organizations are increasingly recognizing the importance of Safe Sport

Consensus statement

International Olympic Committee consensus statement: harassment and abuse (non-accidental violence) in sport

Margo Mountjoy,^{1,2} Celia Brackenridge,³ Malia Arrington,⁴ Cheri Blauwet,⁵ Andrea Carska-Sheppard,⁶ Kari Fasting,⁷ Sandra Kirby,⁸ Trisha Leahy,⁹ Saul Marks,^{2,10} Kathy Martin,^{11,12} Katherine Starr,¹³ Anne Tiivas,¹⁴ Richard Budgett¹⁵



International Olympic Committee. IOC Launches Toolkit For Olympic Movement to Safeguard Athletes from Harassment and Abuse in Sport. <https://www.olympic.org/news/ioc-launches-toolkit-for-olympic-movement-to-safeguard-athletes-from-harassment-and-abuse-in-sport> Accessed August 20, 2018.

Brackenridge C, Kirby S. Playing Safe: Assessing the risk of sexual abuse to elite child athletes. *Int Rev Sociol Sport* 1997;32(4):407-18.

Kirby SL, Kerr GA. Safe Sport Canada Presentation to the Federal Government. August 3, 2018

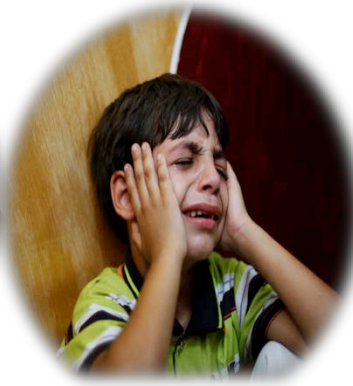
Sylvie P, Guylaine D. Sexual abuse in sport: a model to prevent and protect athletes. *Child Abuse Rev* 2011;20(2):120-33.

Safe Sport International. Challenging Violence in Sport: Safe Sport International Conference. Madrid, Spain: April 6-7, 2018.

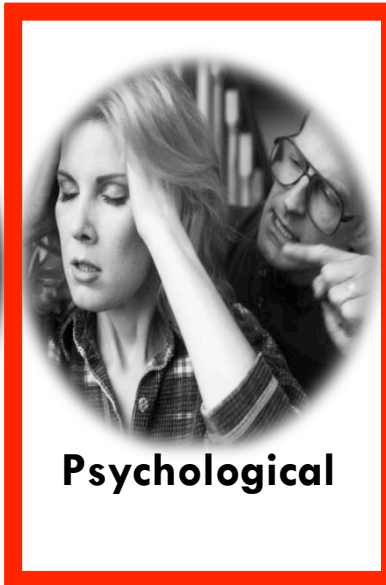
Central concept: a power differential anchors every form of harassment and abuse in sport



Physical



Sexual



Psychological



Financial



Neglect

*Power inequity sets the stage on which maltreatment (a.k.a. intentional violence) can take place; **psychological** abuse is at the core*

No surprise:

Athletes with disabilities are at particularly high risk of intentional harm (\pm daily self-care needs)

Athletes with disabilities

- Youth with impairments (athletes and non-athletes) have 2-3 X increased risk of psychological, physical and sexual abuse compared to able-bodied peers
- Responsibilities among entourage may become blurred, assumptions about and exploitation of athletes' care needs (communication, travel, logistics) make them vulnerable

Quantitative data specific to Para athletes remains sparse



British Journal of Sports Medicine

Non-accidental Harms in Athletes with Impairment: A State-of-the-art Review

| | |
|-------------------------------|--|
| Journal: | <i>British Journal of Sports Medicine</i> |
| Manuscript ID | bjsports-2018-099854.R2 |
| Article Type: | Review |
| Date Submitted by the Author: | n/a |
| Complete List of Authors: | Tuakli-Wosornu, Yetsa; Yale University School of Public Health, Chronic Disease Epidemiology Sun, Qisi; Yale University School of Medicine Gentry, Mark; Yale University School of Medicine, Harvey Cushing/John Hay Whitney Medical Library Ona Ayala, Kimberly; Yale University School of Medicine Doolan, Fiona; University of Dublin Trinity College School of Medicine Ottesen, Taylor; Yale University School of Medicine Caldwell, Blake; University of Colorado Boulder Department of Electrical Computer and Energy Engineering Naushad, Nida; Yale University School of Medicine Huang, Patrick; Yale University School of Medicine Kirby, Sandi; University of Winnipeg, |
| Keywords: | Violence, Sports, Review, Protection, Disability |

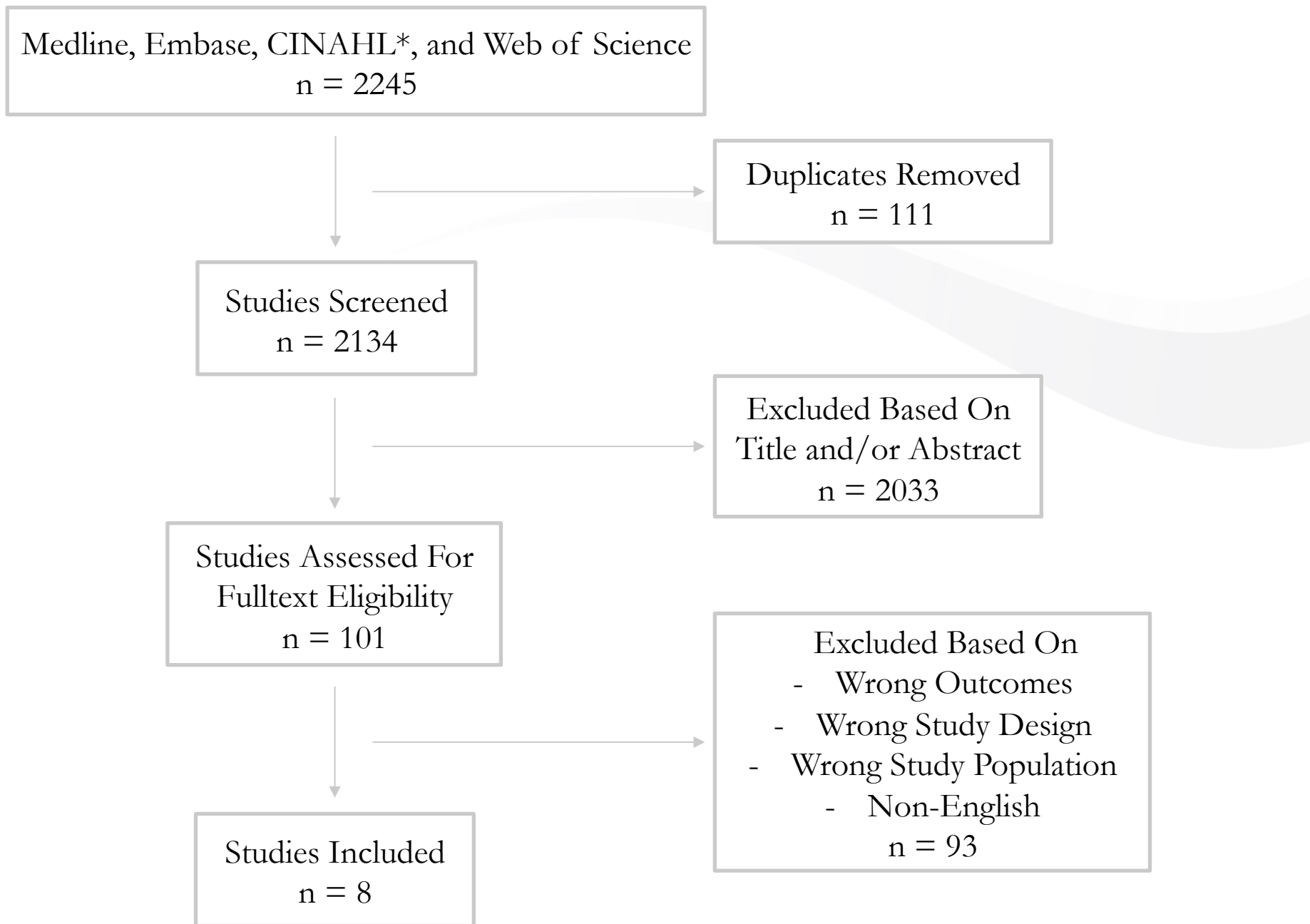


Figure 1. Summary of search results

*Cumulative Index to Nursing and Allied Health

Study characteristics (n=8)

SUMMARY

| | |
|------------------------|--|
| → Year of publication | 2013-17 |
| → Level of evidence | 100% (n=8) Level 4 |
| → Study design | 37.5% (n=3) Quantitative, 62.5% (n=5) Mixed methods |
| → Study location | 37.5% (n=3) U.S., 37.5% (n=3) U.K., 12.5% (n=1) Australia, 12.5% (n=1) Netherlands/Belgium |
| → Study setting | 50% (n=4) Non-school based recreational sports setting (club, camp, community center), 25% (n=2) Regional- National- or International-level tournament, 25% (n=2) School-based recreational sports setting (team, gym class) |
| → Maltreatment studied | Bullying (including cyberbullying), neglect, sexual abuse, physical abuse, psychological and emotional abuse, verbal abuse, ostracism, pranks like hiding things and creating hazards |
| → Population(s) | Youth and adults with a wide range of physical impairments (VI, PI) age 9-50; parents/grandparents of II athletes |

*Levels of Evidence

1. RCT
2. Prospective case control (i.e. cohort) study comparing two groups
3. Retrospective i.e. uncontrolled comparison study
4. Cross-sectional studies and case series (questionnaires, surveys), no reference standard
5. Expert opinion

Type(s) of Maltreatment

- | | |
|----------------------|--------------------------------------|
| 1. Bullying | 6. Financial abuse |
| 2. Hazing | 7. Physical abuse |
| 3. Neglect | 8. Psychological and emotional abuse |
| 4. Sexual harassment | |
| 5. Sexual abuse | |

Select results

2016 Tine Vertommen. *Child Abuse Neglect*.

Interpersonal violence against children in sport in the Netherlands and Belgium

5% (**302**) of 6,042 18-50 year-old citizens surveyed had participated in disability youth sport. **Disability was a predictor for both physical and sexual violence.**

Among those having participated in disabled sports, prevalence estimates were remarkably high for all three types of violence: **prevalence of psychological violence was 49.7%, physical violence 32.4%, sexual violence (33.5%).** Odds ratio for physical violence was 3.2 and odds ratio of sexual violence was 2.9.

2017 Meaghan McHugh. *J Mental Health Res Intellect Disabilities*. Friendship at any cost: parent perspectives on cyberbullying in children with intellectual and developmental disabilities

10 parents and grandparents of children 8+ year old who participated in *Special Olympics Maryland* completed a questionnaire on bullying prevalence, demographics, athlete's use of electronic devices, and then participated in in-depth interviews about the athlete's vulnerability, exposure to aggressive offenders, and specifics about their child's online behavior. **Cyberbullying was common and tolerated for the sake of friendship.**

2017 Lynne McPherson. *J Australian Social Work*. Secrecy surrounding the physical abuse of child athletes in Australia

A mixed methods research design produced **107** survey responses and 10 in-depth interviews with young adult citizens, age 18-25, asked to describe their experiences in sport as a child. **More than a third of the respondents described experiences of overtraining, being forced to train when injured or of direct physical violence.**

British Journal of Sports Medicine

Conclusion

Bullying and other forms of emotional harm perpetrated against young, recreational, visually impaired athletes have received the majority of coverage in the extant literature. However, the true depth and breadth of non-accidental harms in Para athletes remains unknown. This literature gap is concerning, as

<https://mc.manuscriptcentral.com/bjsm>

| | |
|-----------|--|
| | May Whitney Medical Library Ona Ayala, Kimberly; Yale University School of Medicine Doolan, Fiona; University of Dublin Trinity College School of Medicine Ottesen, Taylor; Yale University School of Medicine Caldwell, Blake; University of Colorado Boulder Department of Electrical Computer and Energy Engineering Naushad, Nida; Yale University School of Medicine Huang, Patrick; Yale University School of Medicine Kirby, Sandi; University of Winnipeg, |
| Keywords: | Violence, Sports, Review, Protection, Disability |

Outline



*Primer on the
Contemporary
Paralympic
Movement*

*Epidemiology of
Unintentional and
Intentional
Injuries*

*On-going Gaps in
Knowledge and
Preparedness*

Evidence-based injury prevention in Para athletes

Unintentional Injury

Intentional Injury

What is known:

- The upper extremity is the most commonly injured anatomic area in Para athletes
- Chronic overuse injuries are significantly more common than acute traumatic
- Among Para rowers, cases of diaphragmatic fatigue and rib stress injury have been reported
- Regular, periodic health evaluations may reduce injury rates in elite (i.e. Paralympic) Para athletes

What remains unknown:

- Epidemiology of shoulder and other joint injuries in Para rowers (especially in the weight-bearing shoulder)
- Nature and effectiveness of injury prevention programs in Para rowers at all levels of competition

Evidence-based injury prevention in Para athletes

Unintentional Injury

What is known:

- The upper extremity is the most commonly injured anatomic area in Para athletes
- Chronic overuse injuries are significantly more common than acute traumatic
- Among Para rowers, cases of diaphragmatic fatigue and rib stress injury have been reported
- Regular, periodic health evaluations may reduce injury rates in elite (i.e. Paralympic) Para athletes

What remains unknown:

- Epidemiology of shoulder and other joint injuries in Para rowers (especially in the weight-bearing shoulder)
- Nature and effectiveness of injury prevention programs in Para rowers at all levels of competition

Intentional Injury

What is known:

- Athletes with impairment may be at up to 4 times increased risk of harassment and abuse in sport compared to able-bodied peers
- Bullying among visually impaired, recreational Para athletes has been reported most commonly

What remains unknown:

- True breadth and depth of intentional harms (harassment and abuse) in Para athletes, including Para rowers
- Risk factors for intentional harm in athletes
- Effectiveness of Safe Sport programs, including current grievance mechanisms, in Para rowers at all levels of competition

Evidence-based injury prevention in Para athletes



Evidence-based injury prevention in Para athletes



Athlete and Entourage

- Pre- and Rehabilitation exercises¹
- Pre participation physical exam (+/- specific shoulder girdle muscle balance assessment)
- PPE Ultrasound in high-risk Para athletes?



Federation

- Equipment regulations (if data indicate that injuries are related to equipment or lack thereof)

Summary

True wisdom is
knowing what
you don't know.
-Confucius

Never, never be afraid to
do what's right, especially
if the well-being of a
person...is at stake.

Society's punishments are
small compared to the
wounds we inflict on our
soul when we look the
other way.

-Martin L. King, Jr.

Doing the right
thing is not the
problem. Knowing
what the right thing
is, that's the
challenge.

-Lyndon B. Johnson





Yale University

Taylor Ottesen, Blake Caldwell, Fiona Doolan, Mary Sun

FISA, World Rowing Federation

Jürgen M. Steinacker

Anne Heim

Safe Sport International

Celia Brackenridge, Kari Fasting, Sandra Kirby

International Olympic Committee

Working Group: Prevention of Harassment and Abuse in Sport

International Paralympic Committee

Medical Committee