

Epidemiology of Unintentional and Intentional Injury in Para Athletes: A Narrative Review

Epidemiologie unbeabsichtigter und vorsätzlicher Verletzungen bei Para-Athleten: Eine narrative Übersicht

Summary

- › **Problem:** Sports provide health-related benefits but also confer risk of both accidental (unintentional) and non-accidental (intentional) injuries. Compared to non-disabled athletes, athletes with impairment (Para athletes) are particularly vulnerable to both unintentional and intentional injuries. Despite increasing global Para sport participation, there is a dearth of injury epidemiology scholarship in this group. This literature gap complicates efforts to assess risk factors and develop injury prevention strategies.
- › **Methods:** Published injury epidemiology literature in Para athletes was reviewed. Unintentional injuries were defined as unplanned and resulting from accidents or overuse; intentional injuries were defined as harmful maltreatment (eg, bullying, harassment, abuse, and all other forms of intentional violence).
- › **Results:** Literature on unintentional injury epidemiology in Para athletes is limited, but suggest injury incidence is higher in winter compared to summer Para sports (at the elite level). Ambulant Para athletes are more susceptible to lower extremity injury when compared to seated Para athletes, but overall, the upper extremity is the most commonly injured anatomic region in this group. Literature on intentional injury is similarly scant, but data indicate Para athletes may be up to four times more likely to experience intentional violence in sport compared to non-disabled peers.
- › **Discussion:** Para athletes are significantly more likely to suffer intentional violence when compared to non-disabled athletes. Conclusions are limited by the paucity of studies. Broader population-level research is needed to better understand risk factors and injury prevention strategies.

KEY WORDS:

Sports Injury Epidemiology, Para Athletes, Intentional Violence, Injury Prevention

Introduction

Across the lifespan, individuals with disabilities often experience lower rates of physical activity and organized sport participation when compared to non-disabled individuals (7). External barriers to sport participation include

Zusammenfassung

- › **Problem:** Sport bietet gesundheitliche Vorteile, birgt aber auch das Risiko von zufälligen (unbeabsichtigten) und nicht zufälligen (absichtlichen) Verletzungen. Im Vergleich zu nicht-behinderten Altersgenossen sind Para-Athleten besonders anfällig für unbeabsichtigte und absichtliche Verletzungen. Trotz der zunehmenden weltweiten Beteiligung am Parasport gibt es einen Mangel an Erkenntnissen über die Verletzungsepidemiologie. Diese Literaturlücke erschwert die Beurteilung von Risikofaktoren, die Entwicklung von Präventionsstrategien und das Verständnis der Auswirkungen von Behinderungen auf das Verletzungsmuster.
- › **Methoden:** Die veröffentlichte Literatur zur Verletzungsepidemiologie bei Para-Athleten wurde überprüft. Unbeabsichtigte Verletzungen wurden als ungeplant definiert und resultieren aus Unfällen oder Überlastung; absichtliche Verletzungen wurden als schädliche Misshandlung (z. B. Mobbing, Belästigung, Missbrauch und alle anderen Formen von absichtlicher Gewalt) definiert.
- › **Ergebnisse:** Die Literatur über unbeabsichtigte Verletzungen bei Para-Athleten ist spärlich, deutet aber im Vergleich zu nicht-behinderten Athleten auf eine höhere Rate an unbeabsichtigten Verletzungen hin. Die Verletzungshäufigkeit ist im Winter insgesamt höher als im Sommer beim Parasport. Gehfähige Para-Athleten sind anfälliger für Verletzungen der unteren Extremitäten im Vergleich zu sitzenden Para-Athleten, aber die obere Extremität ist die am häufigsten verletzte Region bei Para-Athleten. Die Literatur über vorsätzliche Verletzungen ist ähnlich dürftig, aber die Daten deuten darauf hin, dass Para-Athleten bis zu viermal häufiger vorsätzliche Gewalt im Sport erleben.
- › **Diskussion:** Para-Athleten sind im Vergleich zu nicht-behinderten Athleten deutlich häufiger Opfer vorsätzlicher Gewalt. Die Schlussfolgerungen sind durch die geringe Anzahl von Studien in dieser Population begrenzt. Die Prävalenz- und Inzidenzforschung auf Bevölkerungsebene ist notwendig, um Risikofaktoren und Strategien zur Verletzungsprävention besser zu verstehen.

SCHLÜSSELWÖRTER:

Sportverletzungsepidemiologie, Para-Athleten, Vorsätzliche Gewalt, Verletzungsprävention

absent or inappropriate environmental adaptations for athletes with disabilities ('Para athletes'), while other limitations are much more complex, including ableist attitudes towards the differently-abled (43). >

REVIEW

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Table 1

Summer and Winter sports at the Paralympic Games

SUMMER SPORTS	WINTER SPORTS
Archery	Alpine skiing
Athletics	Biathlon
Badminton	Cross-country
Boccia	Para ice hockey
Canoe	Snowboard
Cycling	Wheelchair curling
Equestrian	Winter Sports
Football 5-a-side	Alpine skiing
Goalball	Biathlon
Judo	Cross-country
Powerlifting	
Rowing	
Shooting Para Sport	
Sitting volleyball	
Swimming	
Table tennis	
Taekwondo	
Triathlon	
Wheelchair basketball	
Wheelchair fencing	
Wheelchair rugby	
Wheelchair tennis	

Despite this, sport for individuals with physical and/or cognitive disabilities ('Para sport'), can provide a myriad of social and health-related physiological benefits that have been well documented (7, 17). These benefits are balanced by the risk of injury (1, 7, 16, 17, 20, 31, 32, 39, 43). The current study discusses unintentional injury resulting from physical activity and competition, as well as intentional injury (eg, "intentional violence") resulting from abuse, as observed in Para sport. A better understanding of injury epidemiology in this population can help enhance the health and well-being of Para athletes, and promote safe, fair, and inclusive sport overall.

The Contemporary Para Sport Movement and its Role in the Epidemiology of Unintentional and Intentional Injury in Para Athletes

International sport organizations are increasingly integrating Para sport into core programming (20). In the United States for instance, the first national training center for rowers with disabilities ('Para rowers') was recently opened at the Harry Parker Boathouse in Boston USA, through a partnership with USRowing and Community Rowing Inc. Para rowing is one of 28 sports officially recognized by the International Paralympic Committee (IPC). Twenty-two of these sports are included in current summer and six in winter Paralympic Games, the highest level of competitive Para sport (Table 1). Any athlete wishing to participate must demonstrate an eligible impairment in at least one named impairment category (Table 2). At all levels of competition, global Para sport participation has increased significantly in recent years (16). However, increased participation carries increased risk of sports-related injury. The current study seeks to summarize

published literature on the risks of both unintentional and intentional injury in Para athletes, and identify areas for additional research.

Methods

PubMed-indexed literature evaluating the epidemiology of unintentional and intentional injuries in Para athletes was reviewed by five separate reviewers between May and June 2019. Literature was evaluated for relevance to current Para Sport issues, rigor of statistical analysis, and reference to either unintentional or intentional injury to Para athletes. Unintentional injuries are defined as unplanned injuries that result from accidents or overuse during physical training and/or competition, while intentional injuries are distinctly a result of abuse within sport, eg, verbal, physical, sexual and/or emotional abuse by coaches, teammates, or other figures with perceived or real power over the athlete (31).

Results

Unintentional Injuries in Para Athletes

Para athletes experience a different risk profile of unintentional injury in sport when compared to their non-disabled peers, and these injuries can impact athletes' ability to complete not only sport-related tasks, but also basic activities of daily living (ADLs) (1, 39). An estimated 30% of sport-related injuries that Para athletes endure are acute, such as bone fracture, traumatic brain injury, ligament rupture, and/or tendon tear (32). The remaining 70% are minor in nature, largely due to chronic overuse, such as tendon degeneration, muscle contusion, skin abrasion, sunburn and/or decubitus ulcer (32). There does not seem to be any difference in injury prevalence based on gender (10).

Para sport participation may require accommodations related to the impairment; eg, modification of sport-related movements and equipment. As a result, unintentional injury may result when these accommodations are done improperly, or when athletes must physically engage in their sport in a way that increases injury risk. For example, Para rowers often rely on the asymmetric use of their extremities or require adaptive equipment to row such as chest straps – this may increase the risk of musculoskeletal injury (26) such as exercise-induced diaphragm fatigue (30) and overuse rib stress injury (26).

In addition, type of disability influences injury risk. Ambulant athletes are more susceptible to lower extremity injuries, while seated athletes who may use daily wheelchairs are more susceptible to upper extremity injuries (4, 11, 27, 32). The shoulder for instance, is a complex joint that connects the upper limb to the trunk and functions to provide both mobility and stability to the upper extremity (11). Manual wheelchair users utilize the shoulder as a weight-bearing joint. Unlike the hip however, the shoulder is not a traditionally purposed weight-bearing joint, thus wheelchair tasks such as propulsion, start-stop maneuvers, lifts, and transfers can create undue joint strain. The risk of suffering an upper extremity injury is increased in older Para athletes, those who have a spinal cord injury, and those with muscle imbalance about the shoulder girdle (11).

Further, Para athletes such as Para rowers rely on the shoulder for activities related to both sport and daily living, yet upper extremity injuries have not yet been described in Para rowers who regularly use manual wheelchairs, and there is a lack of knowledge of musculoskeletal injury patterns in Para rowers.

Table 2

International Paralympic Committee Impairment Categories (<https://www.paralympic.org>).

IMPAIRMENT CATEGORY NAME	IMPAIRMENT CATEGORY DESCRIPTION
Impaired muscle power	Reduced force generated by muscles or muscle groups, such as muscles of one limb or the lower half of the body, as caused, for example, by spinal cord injuries, spina bifida or polio.
Impaired passive Range of Motion (ROM)	ROM in one or more joints is reduced permanently, for example, due to arthrogyposis. Hypermobility of joints, joint instability, and acute conditions, such as arthritis, are not considered eligible impairments.
Limb deficiency	Total or partial absence of bones or joints as a consequence of trauma (e.g. car accident), illness (e.g. bone cancer) or congenital limb deficiency (e.g. dysmelia).
Leg length difference	Bone shortening of at least 7 cm difference in one leg due to congenital deficiency, illness, or trauma.
Short stature	Reduced standing height due to abnormal dimensions of bones of upper and lower limbs or trunk, for example, due to achondroplasia or growth hormone dysfunction.
Hypertonia	Abnormal increase in muscle tension and a reduced ability of a muscle to stretch, due to a neurological condition, such as cerebral palsy, brain injury or multiple sclerosis.
Ataxia	Lack of coordination of muscle movements due to a neurological condition, such as cerebral palsy, brain injury or multiple sclerosis.
Athetosis	Generally characterized by unbalanced, involuntary movements and a difficulty in maintaining a symmetrical posture, due to a neurological condition, such as cerebral palsy, brain injury or multiple sclerosis.
Visual impairment	Vision is impacted by either an impairment of the eye structure, optical nerves or optical pathways, or the visual cortex.
Intellectual Impairment	A limitation in intellectual functioning and adaptive behavior as expressed in conceptual, social and practical adaptive skills, which originates before the age of 18.

Cognitive impairment also influences patterns of unintentional injury in sport as well. Those with attention deficit hyperactivity disorder (ADHD), epilepsy, autism, and perceptual and communication impairments, such as hearing and visual, are at higher risk of unintentional musculoskeletal injury compared to the general population (41). This may be due to relatively reduced levels of physical fitness, as measured by endurance, balance, and flexibility, which can negatively impact the efficiency of movement patterns and increase risk of pain, strain, and injury (35).

Season and weather conditions can affect the likelihood of sustaining a sport-related injury as well. Generally, injuries tend to be more common during winter Para sports as compared to summer contests (6). At the Winter Sochi Paralympic Games for example, average injury incidence rate (IR) across all sports was 26.5 per 1000 athlete days (95% CI 22.7% to 30.8%) with injuries among Para alpine skiing and Para snowboard athletes being the highest at an IR of 41.1 per 1000 athletes days (95% CI 33.7 to 49.6) (6). In contrast, Para athletes at the summer Paralympic Games in London and Beijing experienced a significantly lower number of injuries with an average incidence rate of only 12 per 1000 athlete-days in Beijing (95% CI 7.1 to 17) and 4.4 per 1000 athlete-days in London across all sports (95% CI 1.1 to 7.6) (10). In London, the greatest injury rates were in Football 5-a-side (IR 22.4 injuries per 1000 athlete-days; 95% CI 14.1 to 33.8), and Goalball (IR 19.5 injuries per 1000 athlete-days; 95% CI 13.2 to 27.7) (37, 42).

Intentional Injuries in Para Athletes

In order for athletes to succeed, it is imperative to foster an environment that upholds the values of 'Safe Sport', defined by the International Olympic Committee as an athletic environment that is respectful, equitable, and free from all forms of intentional violence (21). 'Intentional injury' or 'intentional violence' refer to volitional acts that result, or have the potential to result in, physical and/or psychological harm and are thus in direct violation of the Safe Sport mission (13).

Of note, athletes with a physical and/or intellectual impairment may be up to four times more likely to be victims of intentional violence when compared to athletes without

impairment (21). One study found that of 305 adult recreational and elite Para athletes surveyed about their experiences in sport as children (up until age 18), nearly one-half reported experiencing psychological abuse, nearly one-third reported physical violence, and one-third reported sexual abuse (36). This study also found that Para athletes had increased odds of experiencing abuse compared to non-disabled athletes: 2.90 increased odds of experiencing sexual abuse (99% CI 1.84 to 4.59; $p < 0.001$) and 3.23 increased odds of experiencing physical abuse (99% CI 2.02 to 5.15; $p < 0.001$) (36). Various forms of physical abuse have been reported in the literature, including being shoved, punched, or having something thrown at the body; however, the most common type of physically harmful behavior reported is excessive training or continuing to train when physically injured or exhausted (19, 28).

The Role of Power Imbalance in Intentional Injury in Para Athletes

Power imbalance is at the core of intentional violence in Para and all other athletes. Importantly, the increased risk of abuse among individuals with disabilities is not limited to sport settings, but has been documented within general educational, community, and healthcare institutions (3, 5, 12, 14, 18, 23, 29, 40, 44). A number of factors place athletes (and non-athletes) with impairment at increased risk of abuse, including increased dependence on others, vulnerable living arrangements, and communication limitations (14, 22, 34). Athletes with impairment may be vulnerable to inappropriate contact during routine health interventions such as medication administration due to an impairment that may physically prevent the athlete from contesting. Furthermore, athletes with higher care needs may be at increased risk of intentional violence and more easily exploited by sport actors such as teammates, coaches, and caregivers who assist the athlete with ADLs including transfers, hygiene, dressing and feeding (2, 9, 15, 21). This can take place through bullying by teammates or coaches, being overextended by coaches, or neglect by caregivers. Lastly, athletes with intellectual impairment may experience aggression due to difficulties

with communication, fewer meaningful relationships, and increased assistance required to navigate social and sport settings (24, 25, 45).

Ongoing Gaps in Knowledge

Available data suggest that unintentional and intentional injuries are highly prevalent among athletes with disabilities, but to date, there have been few rigorous studies on these topics. For example, there is a paucity of data regarding unintentional injury for Para rowers and other Para athletes who rely heavily on their (vulnerable) upper extremities. Only two published peer-reviewed citations have been recorded, each of which describes a single, individual Para rower and neither of which address upper extremity injury (26, 30). Further, only one 2018 review summarized current knowledge about intentional violence in athletes with impairment and it included a total of eight citations. The majority of available literature described bullying in young, visually impaired athletes (33). This represents a dearth of information and illustrates that much is still unknown about the true breadth and depth of injury epidemiology in Para athletes, the risk factors for experiencing injury, and the effectiveness of athlete protection programming.

Evidence-Based Injury Prevention Strategies

While few studies involving injury prevention interventions exist in Para sport (8), limited data suggest that preventative training programs may reduce unintentional injury rates in elite (i.e. Paralympic) Para athletes. After mandatory periodic health examinations were introduced before the London Paralympic Games, decreased rates of injury were observed in Polish Para athletes, when compared to observed injury rates at the previous games in Beijing where only 6.6% of Polish athletes completed periodic health examinations (10). Evidence-based policy changes may also contribute to the prevention of unintentional injury in Para athletes, as seen in the 2010 Vancouver Winter Paralympic Games when the number of lower limb fractures for Para ice hockey decreased significantly after a regulation change on protective equipment and sled height (38).

Additional important intentional injury prevention strategies include engaging athletes with resources and organizations that fight for their rights and educate athletes on how to recognize abuse. Believing survivors and validating their suffering is also a critical step towards addressing and preventing intentional injury in Para sport (21).

Conclusion

Despite a myriad benefits, sport can place athletes with disabilities at risk of injury, and current research suggests that Para athletes face different types of unintentional, sport-related injuries than non-disabled athletes. Para athletes face significantly increased risk of intentional injury in sport, however, further research is needed to better understand risk factors and the effectiveness of injury prevention programs, in order to most effectively serve and empower Para athletes worldwide. ■

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Conflict of Interest

The authors have no conflict of interest.

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