

## **PARA SPORT TRANSLATION OF THE IOC CONSENSUS ON RECORDING AND REPORTING OF DATA FOR INJURY AND ILLNESS IN SPORT**

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1 **PARA SPORT TRANSLATION OF THE IOC CONSENSUS ON RECORDING AND**  
2 **REPORTING OF DATA FOR INJURY AND ILLNESS IN SPORT**

3 **ABSTRACT**

4  
5 In 2020, the International Olympic Committee (IOC) proposed a universal methodology for  
6 the recording and reporting of data for injury and illness in sport. Para sport is played by  
7 individuals with impairment, and they have a unique set of considerations not captured by  
8 these recommendations. Therefore, the aim of this addendum to IOC consensus statement  
9 was to guide the Para sport researcher through the complexities and nuances that should be  
10 taken into consideration when collecting, registering, reporting, and interpreting data  
11 regarding Para athlete health. To develop this translation, experts in the field of Para sports  
12 medicine and epidemiology conducted a formal consensus development process, which began  
13 in March 2020 with the formation of a consensus group that worked over eight phases,  
14 incorporating three virtual consensus meetings to finalise the translation. This translation is  
15 consistent with the IOC consensus statement, yet provides more detailed Para athlete specific  
16 definitions and recommendations on study population, specifically, diagnostic and eligible  
17 impairment categorisation and recording of adaptive equipment, and defining and classifying  
18 health problems in the context of Para sport. Additionally, recommendations and Para athlete  
19 specific examples are described with regards to injury mechanism, mode of onset, injury and  
20 illness classification, duration, capturing and reporting exposure and risk. Finally, methods  
21 and considerations are provided to cater to the varied needs of athletes with impairment with  
22 respect to data collection tools. This harmonization will allow the science to develop and  
23 facilitate a more accurate understanding of injury and illness patterns for tailoring evidence-  
24 informed prevention programs and enabling better planning of medical services for Para sport  
25 events.

26  
27 **INTRODUCTION**

28 In keeping with the increased popularity in Para sport over the past several decades, the  
29 number of publications regarding injury and illness in this population of athletes has  
30 increased significantly.[1–4] Data from studies during this period have indicated that in many

1 sport settings, rates of injury and illness are higher in Paralympic athletes than in their  
2 Olympic counterparts.[5–14] Therefore, injury and illness prevention programs are of  
3 importance. The collection and reporting of accurate health data constitutes the first step in  
4 this important process and has been identified as a target for improvement in the Para sport  
5 setting.[1,2,15]

6

7 To gain consistency in definitions, collection and subsequent reporting of injury and illness  
8 data, the IOC produced a consensus statement early in 2020[16], with several follow-up  
9 papers to detail sport specific nuances in data collection and reporting (Tennis  
10 translation[17]; Golf translation[18]) The translation of the IOC consensus statement guides  
11 the Para sport researcher through the complexities of describing athlete impairment types,  
12 classifications, and the health problems associated with sport participation. This  
13 harmonization will allow the science to develop and facilitate a more accurate understanding  
14 of injury and illness patterns for tailoring evidence-informed prevention programs and  
15 enabling better planning of medical services for Para sport events.

16

## 17 **METHODS**

18 This translation was developed after the publication of the IOC consensus statement.[16] This  
19 task was initiated by WD, who acted as chairperson of the consensus group. An initial group  
20 was selected from the medical committee of the IPC and IPC Management Team (WD, CB,  
21 JK, JL, PvV, NW), who are academically experienced in Para sport epidemiology. This group  
22 was expanded to include authors from the IOC consensus statement (CE, BP, MS) and  
23 additional authors with experience in this field (MB, KF, YL, I.SM, KS, RW). A formal  
24 consensus development process was conducted. This process was modified (online only), due  
25 to travel restrictions associated with the novel Coronavirus (COVID-19) pandemic.

26

27 This process was conducted over 9 phases: (1) initial discussions and selection of consensus  
28 group; (2) assignment of designated topic areas to seven working groups; (3) review of  
29 available literature and drafting of proposed definitions, recommendations and Para sport  
30 specific examples by working groups; (4) circulation of a draft with all contributions, 5) a  
31 two-day consensus meeting held on the 29-30 June 2020, during which all contributions were  
32 discussed section by section; (6) revision of drafts by working groups according to input

1 received, and consensus reached during the meetings; (7) a final consensus meeting held on  
2 the 4th of August 2020 to verify all changes; (8) final edits made by an editorial group (WD  
3 and MB); (9) review and approval of the final draft by all authors. In all instances, consensus  
4 was reached unanimously.

5

6 Throughout the document, unless otherwise stated, we are in accordance with the  
7 recommendations of the IOC consensus statement. However, certain definitions, parameters  
8 and examples that relate specifically to Para athletes must be highlighted. The current  
9 document has been specifically written to be read in parallel with the IOC consensus  
10 statement. The ordering of sections varies slightly given that defining the population of Para  
11 athletes is of critical importance and must be considered from the outset of any injury and  
12 illness surveillance work in this population.

### 13 **Terminology**

14 Some important terminology relating to Para sport must be understood. A *Para athlete* is the  
15 International Paralympic Committee’s (IPC) term for a sportsperson with an impairment[19–  
16 21]. This term is used in this consensus statement as it applies to all athletes with an  
17 impairment partaking in sports that are recognised by the IPC. It is different from the term  
18 *Paralympian or Paralympic athlete*, which refers specifically to a Para athlete who has  
19 competed at a Paralympic Games. *Para sport* refers to sports that are played by individuals  
20 with impairment. Importantly, the term “Para sport” should only be used to refer to sports that  
21 are recognised by the IPC,[20] and includes competitors who are affected by one or more of  
22 the 10 eligible impairment types.

23

24 Other often confused definitions include the terms *impairment*, *disability*, and *wheelchair*  
25 *athlete*. The World Health Organization (WHO) in their International Classification of  
26 Functioning, Disability and Health (ICF) defines *impairment* as “any loss or abnormality of  
27 psychological, physiological or anatomical structure or function”.[21] As defined by the  
28 WHO, *disability* is considered “an umbrella term for impairments, activity limitations, and  
29 participation restrictions”.[22, p3] The term ‘wheelchair athlete’ has been used by some  
30 authors, broadly meaning athlete with spinal cord injury, as historically this was the only  
31 impairment at the early Paralympic Games. In the overall research context, this is now  
32 unhelpful as athletes with many different impairments use wheelchairs for their sport or

1 participate in sports without wheelchairs e.g swimming or sailing, but require one for daily  
2 use.[23] Instead, sport-specific and impairment specific terminology should be used.

3

#### 4 **CONSENSUS RECOMMENDATIONS**

### 5 **1. STUDY POPULATION CHARACTERISTICS**

#### 6 **Defining diagnostic and associated impairment categories**

7 As outlined in the IOC consensus statement[16], the athlete’s impairment type and underlying  
8 diagnosis/medical condition must be considered as part of the minimum demographic  
9 information collected in Para sport injury and illness surveillance, given that the background  
10 diagnosis is often intrinsically related to injury and illness risk and is often poorly recorded or  
11 absent.[2,4] For example, an athlete with a complete spinal cord injury who uses a wheelchair  
12 daily, is at heightened risk of shoulder injury, whereas an amputee athlete is at increased risk  
13 for skin injury or illness at the residual limb -socket interface.[10,24,25]

14

15 It is important to note that there remains significant confusion in the sports medicine and  
16 research community regarding the difference between diagnosis, eligible impairment category  
17 and classification category (sport class). To be eligible to compete in Para sport, firstly, an  
18 athlete must have a diagnosis that could lead to an impairment. This impairment must be one  
19 of the 10 eligible impairment types as defined by the IPC classification code (impaired  
20 muscle power; impaired passive range of movement; limb deficiency; leg length difference;  
21 short stature; hypertonia; ataxia; athetosis; vision impairment and intellectual  
22 impairment).[26] For purposes of promoting fair competition in Para sport, athletes are  
23 grouped into functional categories, or classifications, based on the classification rules of the  
24 Para sport Federation, which in turn need to align with the IPC classification code (eligible  
25 impairment).[26] The aim of this classification is to determine how athletes should be grouped  
26 for competition, based on the degree of activity limitation resulting from the impairment.  
27 Additionally, each Para sport code has classification rules which describe the process by  
28 which eligible athletes should be classified.

29 However, to determine injury and illness risk, one must identify the underlying diagnosis or  
30 pathophysiological process that leads to the eligible impairment (e.g., cerebral palsy, which  
31 causes athetosis). Whenever possible, information regarding the athlete’s diagnosis should be  
32 collected directly via the assessment of a licensed/registered clinician or via evaluation of a

1 clinically verified medical record that allows for this to be confirmed, in preference to athlete  
2 or staff self-report.

3

4 Since its inception in 1948, the Paralympic movement expanded from a small competition  
5 involving only athletes with spinal cord injuries, to include athletes with many different  
6 underlying diagnoses.[27] Although the range of potential diagnoses in Para sport is vast, for  
7 injury surveillance purposes, they must be grouped in a pragmatic way to be used in various  
8 global sport settings. This categorization must be sufficiently specific to allow risk  
9 assessment and inform injury and illness prevention strategies. However, if diagnostic  
10 categories are divided into very detailed sub-categories there is a risk that statistical power  
11 will be reduced, and the confidentiality of individuals may be compromised, particularly for  
12 those with a unique diagnosis (e.g., rare genetic conditions). Figure 1 depicts the current  
13 consensus recommendation of how to define and record diagnostic categories for injury and  
14 illness surveillance in Para sport.

15

16 <<Figure 1 near here>>

## 17 **Recording of adaptive equipment**

18 Many Para athletes use adaptive equipment in both their daily lives as well as for sports  
19 participation. Yet athletes with similar impairment types may or may not elect to use the same  
20 kind of adaptive equipment. For example, a unilateral below-knee amputee may either  
21 ambulate with a prosthesis or use a wheelchair for daily mobility. Given the intimate athlete-  
22 equipment interface and its potential to impact loading and biomechanics, this may have a  
23 significant impact on injury or illness risk and should be accounted for in surveillance  
24 programs. Figure 2 depicts the minimum standard consensus recommendations of how to  
25 define and record adaptive equipment categories for injury and illness surveillance in Para  
26 sport. If an athlete reports using more than one type of adaptive equipment in daily life (e.g.,  
27 manual wheelchair and crutches), the equipment used most frequently should be reported.  
28 This scheme does not include various types of sport-specific adaptive equipment (e.g., sport-  
29 specific prosthesis, mono ski, ice hockey sledge). However, these should be taken into  
30 account for research groups wishing to do detailed sport-specific injury and illness risk  
31 analyses. Finally, in athletes with vision impairment, the athlete's guide may also be  
32 implicated in the causation of the injury and in these instances, this should be recorded. The

1 recommended categories represented in both Figures 1 and 2 are also contained in the  
2 example of an injury and illness report form, located in Appendix 2.

3

4 <<Figure 2 near here>>

## 5 **2. DEFINING AND CLASSIFYING HEALTH PROBLEMS IN THE CONTEXT** 6 **OF PARA SPORT**

### 7 **Terminology for health problems**

8 Clarsen et al. define an athletic health problem as “any condition that reduces an athlete’s  
9 normal state of full health, irrespective of its consequences for the athlete’s sports  
10 participation or performance or whether the athlete sought medical attention.”[28] In contrast,  
11 defining ‘health’ for the Para athlete is more complex. Para athletes constitute a  
12 heterogeneous population of people with diverse impairments. They do not conform to the  
13 WHO definition of health as ‘a state of complete physical, mental and social well-being’[29].  
14 A Para athlete by definition, and by the requirement for participation by minimal eligibility  
15 criteria, will have an altered baseline state of ‘health’. Thus, an athletic health problem should  
16 be recorded when an athlete moves from *any* state of health, to a ‘less-healthy’ state.[30]  
17 In the Para athlete, the impairment *per se* may have associated co-morbidities that present in  
18 the sporting environment but are not a direct consequence of sport participation itself. While  
19 this remains valuable information for healthcare planning, it needs to be considered a  
20 confounder in terms of attribution from an epidemiological perspective. The nature of the  
21 Para athlete’s impairment may also result in a change in the baseline state of health over time,  
22 which might result in different levels of risk for injury or illness (see Table 1 for examples of  
23 confounders). For these reasons, the consensus group strongly recommends the use of the pre-  
24 participation evaluation (PPE), periodic health evaluation (PHE) and the collection of health  
25 data in the form of longitudinal studies.

26



1 **Table 1:** Examples of co-morbidities associated with certain diagnoses.

2

<b>Diagnosis</b>	<b>Associated co-morbidity</b>	<b>Comment</b>
Spinal cord injury – wheelchair basketball	Urinary tract infection associated with neuropathic bladder	Not necessarily sport related
Neuromuscular disorder/muscular dystrophy– shooting Para sport	Decreasing muscle strength and/or cardiac function	Decreasing baseline of health over time and cardiac risk
Bilateral above knee amputee -handcycling	Phantom limb pain - athlete utilizes regular endurance exercise as a form of pain management	Increased risk of shoulder pain deemed necessary by the athlete to manage mental health
Vision impairment - Para swimming (e.g., Pseudoxanthoma elasticum, Stickler Syndrome)	Collagen disorder causing sight loss but also affects soft tissue	Increased risk of injury and impaired healing of tissues

3

4 **Defining injury and illness**

5 We concur with the IOC consensus statement’s definitions of injury and illness, but  
 6 definitions require consideration of whether this relates to the existing impairment in a  
 7 sporting or non-sporting context, as outlined below.

8 **Relationship to sports activity**

9 We concur with the IOC consensus statement that health problems may result either *directly*,  
 10 *indirectly*, or *not at all related to participation in sport*. Examples within a Para sport context  
 11 are shown in Table 2.

12

1 **Table 2:** Relationship to sports activity within Para context

2

Health problems may result:	Para translation
1. <b>Directly</b> from participation in competition or training in the fundamental skills of a sport (e.g., players colliding in a match, a gradual onset injury from repetitive training or transmission of a skin infection from contact with another player)	<ul style="list-style-type: none"> <li>• A vision impaired athlete sustains a lower limb fracture in alpine skiing</li> <li>• An amputee snowboarder develops a skin infection in the residual limb</li> <li>• A football 5-a-side player sustains a concussion through a collision with another player</li> </ul>
2. <b>Indirectly</b> from participation in activities that relate to competition or training in a sport, but not during competition or a training session (e.g., slipping, falling and sustaining an injury when in the Paralympic village, developing an illness following international travel to a competition or an illness deemed to be related to an increased training load over a few weeks)	<ul style="list-style-type: none"> <li>• A vision impaired athlete falls and sustains a laceration due to an unfamiliar environment</li> <li>• Para athlete with spinal cord injury develops a urinary tract infection after long-haul travel</li> </ul>
3. <b>From activities that are not at all related to participation in sport</b> and occur in the absence of participation during competition or training in the fundamental skills of a sport (e.g., car crash, sudden cardiac arrest at home)	<ul style="list-style-type: none"> <li>• An athlete with cerebral palsy sustains an injury as a result of a seizure triggered by flickering lights in a shopping mall</li> <li>• An athlete with spinal cord injury experiences autonomic dysreflexia due to a urinary tract infection</li> </ul>

3 **Mode of onset**

4 *Mode of onset – injury and illness*

5 It is important to note that several studies in Para sports have focused on reporting acute  
 6 injuries at short competitions (3–23 days), while there remains a lack of longitudinal studies

1 that could allow a better understanding of the epidemiology of gradual onset injuries, and the  
2 occurrences of illnesses over time.[1,2]

### 3 **Classifying mode of onset**

4 We concur with the IOC consensus statement that data collectors should consider whether a  
5 health problem results from a clear acute mechanism, clear repetitive mechanism or a mix of  
6 both elements. We have included Para specific examples in Table A of Appendix 1.

### 7 **Classifying the mechanism of injury**

8 A similar classification system to the IOC consensus statement is applicable, with the sub-  
9 division of contact into fixed objects and moving objects, as in the Tennis translation of the  
10 IOC consensus statement.[17] This classification is relevant to various Para sport settings.

11

1 **Table 3.** Examples: classification of contact as a mechanism for sudden-onset injury (adapted  
 2 from Verhagen et al.[17]  
 3

<b>Injury</b>	<b>Type of contact</b>		<b>Para translation</b>
<b>Non-contact</b>	None	No evidence of disruption or perturbation	A wheelchair sprinter experiences sudden pain in the shoulder during a race.
<b>Contact</b>	Indirect	With another athlete	An outfield football 5-a-side player (football played by athletes with vision impairment who have very low visual acuity and/or no light perception) trips over another player's leg, causing a lateral ankle ligament sprain.
	Indirect	With a fixed object	A Para snowboarder loses control and accidentally hits a gate which causes him to tumble and sprain his wrist.
	Indirect	With a moving object	A wheelchair basketball player is hit on the head by a ball, causing her to lose balance and fall, spraining her wrist.
<b>Contact</b>	Direct	With another athlete	A vision impaired player sustains a concussion from a collision with another player in a football 5-a-side game.
	Direct	With a fixed object	A Para ice hockey player is checked into the boards and dislocates his shoulder.

Direct      With a moving object      A sitting volleyball player is hit on the head by a spiked ball and sustains a concussion.

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1

2 **Multiple events, subsequent, recurrent and/or exacerbation of health problems in Para**  
3 **sports epidemiology**

4 The IOC consensus statement emphasises that in sports injury and illness epidemiology, there  
5 is a relatively high likelihood that an athlete will experience more than one health problem  
6 over a study period.[16] Figure 3 of the IOC consensus statement depicts a classification tree  
7 for subsequent health problems (adapted from Hamilton et al[31]) that is particularly useful in  
8 the categorisation of these subsequent injuries/illnesses and exacerbations in sport. In Para  
9 sports injury and illness epidemiology, this categorisation is especially relevant. This is  
10 because Para athletes experience a higher number of injuries and illness per athlete and due to  
11 their health condition also can have a higher number of subsequent injuries, exacerbations,  
12 and recurrences of illness and injury.[12,32] Therefore, in Para sports injury and illness  
13 epidemiology, the following should be recorded for any subsequent injuries: whether it is a)  
14 subsequent recurrent (i.e. same injury type as index injury, e.g. a recurrent rotator cuff tear);  
15 b) subsequent local injury affecting the same location as the index injury but other tissues  
16 (e.g., shoulder, but acromioclavicular joint instead of the rotator cuff); or c) subsequent but  
17 affecting other location to the index injury. Recurrent injuries are exacerbations if the index  
18 injury is not fully healed.

19

20 Similarly, for subsequent illnesses it should be recorded if the subsequent illnesses are a)  
21 subsequent recurrent (i.e., same diagnosis as index illness e.g., recurrent urinary tract  
22 infection); b) subsequent local affecting the same system (e.g., urogenital) but another  
23 diagnosis (e.g., catheter site infection or cystitis); or c) subsequent but other systems.  
24 Recurrent illnesses are exacerbations if the index illness has not fully recovered. Examples of  
25 subsequent health problems in Para sports injury and illness epidemiology can be found in  
26 Table 4.

27

1 **Table 4.** Examples of subsequent health problems in Para sports injury and illness

2 epidemiology

3

<b>Index injury</b>	<b>Subsequent injury</b>			
	<b>Recurrent injury</b>		<b>Local injury</b>	<b>New injury</b>
	<b>Re-injury</b> (same site and same type as the index injury, index injury was healed/fully recovered)	<b>Exacerbation</b> (same site and same type as the index injury, index injury not yet healed/fully recovered)	(same location but different tissue type)	(different location and tissue type)
Rotator cuff tendinopathy in an athlete with spinal cord injury using a wheelchair for racing	Acute rotator cuff tear in this athlete	Recurrent rotator cuff tear	Acromioclavicular joint sprain in this athlete	Acute wrist sprain in this athlete
<b>Index illness</b>	<b>Subsequent illness</b>			
	<b>Recurrent illness</b>		<b>Local illness</b>	<b>New illness</b>
	<b>Repeated illness</b> (same organ system and same type as the index illness, index illness fully recovered)	<b>Exacerbation of illness</b> (same organ system and same type as the index illness, index illness not yet fully recovered)	(same organ system but different illness type)	(different organ system and illness type)

Neurogenic bladder in an athlete with spinal cord injury	Urinary tract infection in this athlete	Pyelonephritis	Skin infection at the catheter site in this athlete	Upper respiratory tract infection in this athlete
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1

## 2 **Classifying sports injury and illness diagnoses**

3 We recommend following the IOC consensus statement to classify injury and illness  
4 diagnoses. The diagnoses in the IOC consensus statement are based on the Orchard Sports  
5 Injury and Illness Classification System (OSIICS), the Sport Medicine Diagnostic Coding  
6 System (SMDSC), and the International Classification of Disease (ICD).[33,34] These coding  
7 systems were recently updated to include some common Para athlete specific codes, for  
8 example, common amputation sites. For athletes with amputation or congenital limb  
9 anomalies, residual limb injuries can be recorded according to their primary anatomical area,  
10 e.g., upper or lower limb. Researchers can choose to be more specific and add the specific  
11 amputation level, e.g., above the knee (transfemoral) or the elbow (transhumeral). An  
12 expanded list of all amputations is shown in Table B of Appendix 1.

13

14 It is noteworthy that some tissue types and pathology related to Para athletes' diagnoses are  
15 not included as Para athlete specific conditions in the existing systems (OSIICS and  
16 SMDCS).[33] For example, a pressure ulcer is a frequent and often severe tissue injury that  
17 affects athletes with reduced sensation. Among athletes with neurological impairment, joint  
18 contractures may be present as well as other nervous system-related injuries.[12,35,36]  
19 Therefore, we recommend researchers to identify and record the impairment-specific tissue  
20 injuries and pathology that may be present in the Para athlete population. See examples in  
21 Table 5.

22

1 **Table 5.** Examples of additional categories of tissue and pathology types for injuries in Para  
 2 athletes.

Tissue	Pathology
Nervous system	Hypertonia Central neurological pain Phantom pain
Ligament/Joint capsule	Contracture
Superficial tissue/skin	Pressure ulcer

4  
 5 It is also possible to use diagnostic codes from the ICD-10 and ICD-11 in instances where  
 6 diagnoses cannot be found.[12,36]

7 **Illness—categories for organ system and aetiology**

8 Paralympic athletes have significantly higher rates of illness than their Olympic counterparts  
 9 with unique medical conditions related to their type of diagnosis, such as autonomic  
 10 dysreflexia, pressure injuries, neurogenic bladder, premature osteoporosis, and neuropathic  
 11 pain.[3] Para athletes also have more skin and subcutaneous lesions related to insensate skin  
 12 and residual limb/prosthesis interface pathology.[24,37,38] For example, non-traumatic skin  
 13 lesions on the residual limb in amputees, or sunburn/frostbite on insensate skin, need to be  
 14 categorised separately from other dermatological conditions, and a hypertensive crisis due to  
 15 autonomic dysreflexia should be recorded separately from common neurological or  
 16 cardiovascular conditions listed in ICD-10 and ICD-11.

17  
 18 We recommend adding these specific medical conditions in Para athletes as sub-categories in  
 19 existing categories of organ system/region in the IOC consensus statement. For example,  
 20 insensate skin and/or residual limb can be included as a sub-category of the dermatological  
 21 system. For cases of autonomic dysreflexia in spinal cord injury or seizure in brain injury, a  
 22 subcategory of the central nervous system, peripheral nervous system, and autonomic nervous  
 23 system can be added to the nervous system. We recommend adding a “comorbidity of  
 24 existing diagnosis to the categories for aetiology of illness for these unique medical  
 25 conditions in Para athletes as in Table 6.

26



1 **Table 6.** Examples of medical conditions specific to Para athletes as a result of existing  
 2 diagnoses.  
 3

<b>Diagnosis</b>	<b>Medical Problems</b>
Spinal cord injury	Pressure ulcers Autonomic dysreflexia Urinary tract infection Premature osteoporosis Renal calculi Neuropathic pain Pulmonary dysfunction
Poliomyelitis	Premature osteoporosis Osteoarthrosis Nociceptive pain
Amputee	Residual limb infection Phantom limb pain
Cerebral Palsy / Brain Injury	Convulsive disorders Depression Fatigue

4 This table should be read in conjunction with table 7 of the IOC consensus statement.

5 **3. SEVERITY OF HEALTH PROBLEMS**

6 **Time loss from training and competition**

7 We agree with the IOC consensus statement that investigators should consider the strengths  
 8 and limitations of different approaches and the objectives of their study or surveillance  
 9 programme, when deciding which severity measures to use. Similarly, we agree with the IOC  
 10 consensus statement that time loss is the most commonly used criterium for assessment of  
 11 severity. Table C in Appendix 1 gives practical examples of how to calculate time loss in the  
 12 Para athlete setting. Using ‘time loss’ for Para athletes has the same limitations as for able-

1   bodied athletes, yet, there are additional considerations and complexities. For example,  
2   athletes who use a wheelchair for their sport and sustain an injury to one functional arm may  
3   lose independence in daily life, making the impact of such an injury of greater severity than  
4   the number of days lost from sport or training alone.

5  
6   The decision to monitor additional severity parameters, such as non-sport related functional  
7   limitations and pain, will depend on the aim of the research. For Para athletes with specific  
8   underlying diagnoses, there are outcome measures used in disability research that can be  
9   relevant, specifically for evaluation of the impact of the individual’s impairment on their  
10   activities of daily living. One such example is the Wheelchair Users Pain Shoulder Index  
11   (WUSPI).[39] The WUSPI is a simple and effective self-reported questionnaire for rapid  
12   assessment of the functional impact of shoulder pain in wheelchair users. Another example is  
13   the Sports-related Injury and Illness in Paralympic Sport Study (SRIIPSS) that included self-  
14   reported injuries, illnesses, impairment related symptoms and other health parameters such as  
15   pain, anxiety, sleep and use of medications.

16

### 17   **Para athlete reported symptoms and consequences**

18   Existing tools for able-bodied athletes that allow self-reporting of data (e.g., symptom  
19   recording and training exposure) require adaptation for the Para sport environment. For  
20   example, reporting tools should allow vision impaired athletes and athletes with an  
21   intellectual impairment to respond and provide their data on the system Specific accessibility  
22   considerations are described in detail under “Data collection methods”. Also, some Para  
23   athletes with more severe impairments who have higher needs with respect to daily activities  
24   might require the assistance of another person to respond and provide data. It should also be  
25   possible to include other health symptoms and consequences such as pain, sleep, well-being,  
26   medications as well as functional and mental limitations if necessary. An example of one such  
27   electronic system is the Sports-related Injury and Illness in Paralympic Sport Study  
28   (SRIIPSS) eHealth application, which has been specifically developed for all types of Para  
29   athletes.[13]

30

1 **Recording the severity of health problems based on clinical assessment**

2 As the athlete’s health can fluctuate due to underlying medical conditions and changes in the  
3 impairment, we recommend that sufficient baseline data at the time of the PPE are gathered  
4 and recorded, to allow a point of reference for the assessment of subsequent health problems.  
5 As access to health care can vary considerably for Para athletes, the PPE is rarely conducted  
6 in some countries. Therefore, it is a challenge to report the subsequent severity of the athletes’  
7 current clinical assessment, as there is no initial benchmark. If baseline health state is  
8 unknown prior to the recorded injury or illness, this should be indicated in the injury report. If  
9 possible, patient interviews may help identify changes in health state in athletes who do not  
10 have well documented health histories. Furthermore, the advent of telemedicine and eHealth  
11 approaches might mitigate this particular challenge and may become increasingly popular as  
12 an assessment and data collection tool.

13  
14 **Other severity measures**

15 It is important for researchers to consider that certain patient-reported outcome measures for  
16 able-bodied athletes cannot be readily used for Para athletes without specific development  
17 and testing. One such example is the sports concussion instrument, Sport Concussion  
18 Assessment Tool (SCAT), which cannot be adopted for Para athletes without further  
19 development.[40] In these instances, we recommend the the adaptation and validation  
20 existing sports-related outcome measures for Para athletes.

21  
22 **4. CAPTURING AND REPORTING ATHLETE EXPOSURE**

23 Apart from the differences in types of sport for Para athletes compared to able-bodied  
24 athletes, the fundamental principles of capturing and reporting exposure, as described in the  
25 IOC consensus statement, remains the same. As Para sport types are varied and take place  
26 both in the winter and summer sport settings, we recommend exposure measures to be sport-  
27 specific (e.g., total athlete distance covered, athlete time in competition, number of athlete  
28 bouts/fights, athlete days) (Table D in Appendix 1). The context of recording training  
29 exposure in Para sport should be sport- and athlete-specific and consider categories of general  
30 strength and conditioning, and injury-specific rehabilitation targeting safe return to sport.

## 1           **5. EXPRESSING RISK**

2   Whilst we agree with the recommendation of the IOC consensus statement regarding point  
3   prevalence and period prevalence, understanding of these requires a consideration of the  
4   complexity of Para sport taking into account the high prevalence of pre-existing medical  
5   conditions chronic pain, co-morbidities and prolonged use of adaptive equipment.[3] Thus,  
6   injury and illness incidence rates may underestimate the true burden given the high  
7   prevalence of pre-existing repetitive gradual onset injuries and medical conditions. Also,  
8   when collecting data in multi-sport events, and when exposure data are incomparable between  
9   sports,[25,36,41] we recommend expressing incidence as the number of new cases/number of  
10   athletes or athlete days. Sport-specific incidence rates may be more optimally expressed by  
11   number of health problems/1000 matches (e.g., badminton, boccia, football, goalball, judo,  
12   sitting volleyball, table tennis, wheelchair basketball, wheelchair fencing, wheelchair tennis)  
13   or number of injuries/1000 competitions or events (e.g., archery, athletics, canoe, cycling,  
14   equestrian, power lifting, rowing, shooting, swimming, taekwondo, dance).

## 15           **6. BURDEN OF HEALTH PROBLEMS**

16   Time loss-based severity measures also under-represent gradual onset injuries and illnesses,  
17   which are particularly prevalent in the Para sport population.[12,14,36] In this context, we  
18   recommend the use of mean severity scores (measured as arbitrary units) by the Oslo Sports  
19   Trauma Research Center – Health (OSTRC-H) questionnaire, instead of measuring only time  
20   loss from sports participation.[42] This questionnaire has been used in Para sport health  
21   monitoring, with the exception of vision impaired athletes.[14] New versus pre-existing  
22   morbidity must be clearly delineated in the Para sport population where exacerbations are  
23   prevalent.

## 24           **7. DATA COLLECTION METHODS**

25   In Para sport, there are different factors relating to the Para athletes' impairment that should  
26   be considered when data are collected. As such, there is a need for flexibility regarding data  
27   collection methods in order to adapt to specific context and population differences that will  
28   improve validity and reliability.[2,13,16] Various considerations in this regard are shown in  
29   Table 7. We recommend that researchers think carefully about these, and other potential  
30   considerations that may be present with their own, specific research contexts.

1 For prospective data collection over time and throughout a season, methods adapted to Para  
2 athletes based on self-reports have successfully been developed and evaluated within the  
3 SRIIPSS and other longitudinal surveillance projects.[13,14,43] An example of an injury and  
4 illness report form in Para sport, adapted from the IOC consensus statement and SRIIPSS, is  
5 provided in Appendix 2.[12,13,16,44,45]

6  
7 eHealth based self-report data collection may be especially beneficial, as it can empower  
8 health efficiency and autonomy for persons with an impairment due to more accessible  
9 opportunities for communicating health parameters.[44] Digital data collection of other health  
10 parameters, such as heart rate and energy expenditure, could also be a feasible method among  
11 Para athletes due to a large variation in physiology and training.

## 12 **Accessibility considerations**

13 There are guidelines and regulations in various countries that may facilitate accessibility for  
14 web interfaces, mobile applications, etc. In the United States of America, for example,  
15 researchers may collaborate with experts of the Americans with Disabilities Act (ADA), to  
16 ensure their surveillance tools meet ADA guidelines. However, to encourage uniformity and  
17 ensure accessibility and validity for all data collection methods for Para athletes, we  
18 recommended following the Web Content Accessibility Guidelines. To ensure accessibility  
19 for athletes with vision impairment, it is recommended to avoid using paper and pen for blind  
20 athletes, and scales and pictures must be avoided. These methods can, however, be considered  
21 for partially sighted athletes if large text is used. eHealth based data collection can be used  
22 advantageously in this population, but it is important to ensure that the method is compatible  
23 with multiple devices, speech synthesizers and braille.[43,44]

24  
25 For athletes with intellectual impairment, it is important to use data collection methods  
26 containing easily understandable terminology and to allow visual cues and free text answers.  
27 For some athletes with more severe physical impairments, such as tetraplegia, it is  
28 recommended to avoid pen and paper and adapt eHealth based options with assistive  
29 technology for writing.[44] It is important to consider the provision of support personnel to  
30 assist with data collection among some athletes with impairment.[43]

31

1 **Table 7.** Para sport specific additions concerning data collection methods to the IOC  
 2 consensus statement.  
 3

<b>Data collection concerns</b>	<b>Considerations</b>
Data collected during competitions	<ul style="list-style-type: none"> <li>• Para athletes often do not have access to a team physician (and physician experience can vary greatly), consider whether data can be reported by other medical staff, coaches or athletes themselves</li> <li>• Consider how diagnosis is made (e.g., with objective methods such as imaging)</li> <li>• Consider collecting data in several languages</li> </ul>
Data collected during training seasons	<ul style="list-style-type: none"> <li>• A global injury/illness reporting app/software that allows each Para sport to record their data is preferable[44]</li> <li>• Prospective data collection of self-reports can be recommended where athletes do not have access to medical staff[32]</li> </ul>
Accessibility concerns of impairment groups within the Paralympic movement <i>Athletes with vision impairment</i>	<ul style="list-style-type: none"> <li>• Adapt electronic reporting to different devices and speech synthesizers</li> <li>• Avoid pen and paper</li> <li>• Use large text and consider braille</li> <li>• Avoid pictures and scales</li> </ul>
<i>Athletes with intellectual impairment</i>	

- Use easy and understandable terminology
- Provide free text options
- Provide visual cues

*Athletes with (severe) physical impairment*

- Avoid pen and paper
  - Adapt electronic reporting to different devices and assistive writing technology
- 

1  
2 Finally, the IOC consensus statement highlights the importance of ethics in research and data  
3 security. In the context of Para sport, we urge researchers to carefully consider and ensure the  
4 protection of dignity and rights of participants, especially as some Para athletes may be  
5 considered persons at risk or vulnerable, due to their specific impairment.  
6

7 **CONCLUSION**

8 Accurate and standardised use of specific definitions, methods and parameters to collect and  
9 report epidemiological data in the complex Para sport environment is an important step in the  
10 prevention of injury and illness and protection of health of the Para athlete. In response to the  
11 recent IOC consensus statement on methods for recording and reporting of  
12 epidemiological data on injury and illness in sport, experts in the field of Para sports medicine  
13 have translated this consensus statement into a Para sport context. This Para sport translation  
14 offers more detailed impairment and sport specific information that will allow researchers in  
15 this field to better record and report both injuries and illness.

16 **COMPETING INTERESTS**

17 None of the authors report competing interests.

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20

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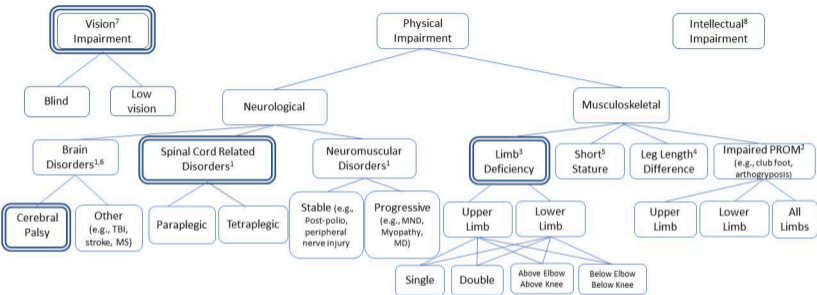


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1 **Figure 1.** Schematic representation of suggested diagnostic categorization and relation to IPC  
2 eligible impairments, for Para sport illness and injury surveillance and monitoring  
3 programs.[46] Note: It is recommended that at the very minimum, the large diagnostic or  
4 impairment groups as indicated in the double outlined boxes, should be recorded  
5  
6 **Figure 2.** Schematic representation of suggested mobility aid categorisation for Para sport  
7 illness and injury surveillance.



TBI=traumatic brain injury  
 MS=multiple sclerosis  
 MND=motor neuron disease  
 MD=muscular dystrophy  
 PROM=passive range of movement

Indicates  
 Impairment /  
 diagnosis with  
 high prevalence  
 in Paralympic  
 athletes

#### IPC Eligible Impairments –Classification

- |                          |                                  |
|--------------------------|----------------------------------|
| 1. Impaired muscle power | 6. Hypertonia, Ataxia, Athetosis |
| 2. Impaired PROM         | 7. Vision Impairment             |
| 3. Limb deficiency       | 8. Intellectual Impairment       |
| 4. Leg length difference |                                  |
| 5. Short stature         |                                  |

## Appendix 1

### Consensus group composition.

<b>Member</b>	<b>Country</b>	<b>Profession</b>	<b>Field / Related expertise</b>
Wayne Derman	South Africa	Sports medicine physician	<ul style="list-style-type: none"> <li>- Director: Institute of Sport and Exercise Medicine (Stellenbosch University) and co-director IOC Research centre (South Africa)</li> <li>- IPC Medical committee member</li> <li>- IPC Research lead for Paralympic injury and illness surveillance (WEB-IISS)</li> <li>- CMO of South African Olympic team 1999-2005; South African Paralympic team 2008-2013</li> <li>- Co-author of the IOC injury/illness consensus</li> <li>- Co-author of the tennis-specific extension of the IOC injury/illness consensus.</li> </ul>
Marelise Badenhorst	South Africa	Physiotherapist	<ul style="list-style-type: none"> <li>- Impairment Research associate: Institute of Sport and Exercise Medicine (Stellenbosch University) and IOC Research centre (South Africa)</li> </ul>
Cheri A. Blauwet	USA	Sports medicine physician	<ul style="list-style-type: none"> <li>- IPC Medical committee</li> <li>- IOC Medical &amp; Scientific Commission</li> <li>- Co-author of the cycling-specific extension of the IOC injury/illness consensus</li> <li>- Athlete voice: Retired Paralympian</li> </ul>
Carolyn A. Emery	Canada	Physiotherapist / Epidemiologist	<ul style="list-style-type: none"> <li>- Co-author of the IOC injury/illness consensus.</li> <li>- Director IOC research centre Calgary, Canada</li> </ul>
Kristina Fagher	Sweden	Certified Sports Physiotherapist	<ul style="list-style-type: none"> <li>- PhD Sports-related Injuries and Illnesses in Paralympic athletes</li> <li>- Medical committee, Swedish Paralympic committee</li> </ul>

			<ul style="list-style-type: none"> <li>- Medical committee, International Blind Sports Association</li> </ul>
Young-Hee Lee	South Korea	Sports and Rehabilitation medicine physician	<ul style="list-style-type: none"> <li>- Chief Medical Officer, 2018 PyeongChang Winter Paralympic Games</li> <li>- Director, Institute of Sport Science and Exercise Medicine</li> </ul>
James Kissick	Canada	Sports medicine physician	<ul style="list-style-type: none"> <li>- IPC Medical committee</li> <li>- Former team physician Canadian Para Ice Hockey Team</li> </ul>
Jan Lexell	Sweden	Rehabilitation medicine physician, Sports medicine physician	<ul style="list-style-type: none"> <li>- IPC Medical committee</li> <li>- Former Chief Medical Physician, Swedish Paralympic Committee</li> </ul>
I. Stuart Miller	UK	Sports medicine physician	<ul style="list-style-type: none"> <li>- Chief Medical Officer to the British Paralympic Association</li> </ul>
Babette Pluim	Netherlands	Sports medicine physician	<ul style="list-style-type: none"> <li>- Co-author of the IOC injury/illness consensus.</li> <li>- Co-author of the tennis-specific extension of the IOC injury/illness consensus.</li> <li>- Co-author of the cycling-specific extension of the IOC injury/illness consensus.</li> <li>- International Tennis Federation Classification Consultant</li> </ul>
Martin Schweltnus	South Africa	Sports medicine physician	<ul style="list-style-type: none"> <li>- Director: Sport, Exercise Medicine and Lifestyle Institute (SEMLI) and IOC Research Centre (South Africa)</li> <li>- Co-author of the IOC injury/illness consensus</li> <li>- Member: IOC Medical and Science group</li> <li>- IPC Medical committee (Co-opted member at the 2012, 2014, 2016 and 2020 Paralympic Summer / Winter Games)</li> </ul>
Kathrin Steffen	Norway	Epidemiologist	<ul style="list-style-type: none"> <li>- IOC Medical &amp; Scientific Commission</li> </ul>

			<ul style="list-style-type: none"> <li>- Para athlete health team, Norwegian Olympic Training Center</li> </ul>
Peter Van de Vliet	Germany	Physiotherapist	<ul style="list-style-type: none"> <li>- Former Medical &amp; Scientific Director International Paralympic Committee</li> </ul>
Nick Webborn	UK	Sports medicine physician	<ul style="list-style-type: none"> <li>- IPC Medical committee</li> <li>- Athlete voice: Retired Para athlete</li> </ul>
Richard Weiler	UK	Sports medicine physician	<ul style="list-style-type: none"> <li>- PhD Para Sports Injuries</li> <li>- Medical committee, International blind sports association and Para football</li> <li>- Paralympics GB Medical officer</li> </ul>



## Appendix 2

An example of an injury and illness report form in Para sport, adapted from the IOC consensus statement of methods for recording and reporting of epidemiological data on injury and illness in sport and the Sports-related Injury and Illness in Paralympic Sport Study (SRIIPSS)[1–4]

### Baseline information

1. Athlete information (e.g. gender, age, BMI, use of medications, impairment-related health concerns, previous sports injuries and illnesses, access to medical service, minutes of training per week/session, match exposure)

2. Impairment

Vision impairment

*Low vision*

*Blind*

Physical impairment

Neurological

*Brain Disorder*

*Cerebral Palsy*

*Other (e.g. TBI, Stroke, MS)*

*Spinal Cord Related Disorders*

*Para*

*Tetra*

*Neuromuscular Disorders*

*Stable (e.g., Post-polio, Peripheral nerve injury)*

*Progressive (e.g. MND, Myopathy, MD)*

Musculoskeletal

*Limb Deficiency*

*Upper Limb*

*Single*

*Double*

*Above elbow*

*Below elbow*

*Lower Limb*

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- Single*
- Double*
- Above knee*
- Below knee*
- Short Stature*
- Leg Length Difference*
- Impaired Passive Range of Movement (e.g. club foot, arthrogyriposis)*
  - Upper Lib*
  - Lower limb*
  - All limbs*
- Intellectual impairment

### 3. Adaptive equipment

- Power wheelchair
  - For all activities*
  - For ADLs only*
- Manual Wheelchair
  - For all activities*
  - For ADLs only*
  - For sport only*
- Prosthesis
  - Upper limb*
    - For all activities*
    - For ADLs only*
    - For sport only*
  - Lower limb*
    - For all activities*
    - For ADLs only*
    - For sport only*
- Crutches
- Walking frame
- Stick
- Personal assistance /guide
  - For all activities*

- For ADLs only*
- For sport only*

#### 4. Para sport

- Summer sport

*Specific Summer Sport:* \_\_\_\_\_

- Winter sport

*Specific Winter Sport:* \_\_\_\_\_

### **Injury report form**

1. Did the athlete/you report any injury that reduced the athlete's normal state of full health, irrespective of its consequences on the athlete's sports participation or performance or whether the athlete sought medical attention?

- No
- Yes
  - Directly from participation in training or competition*
  - Indirectly from participation in training or competition*
  - From an activity that is not related to sports participation*

#### 2. Mode of onset of injury

- Acute with a sudden onset
- Repetitive with a sudden onset
- Repetitive with a gradual onset

#### 3. Injury mechanism

- Non-contact
- Contact
  - Indirect*
    - With another athlete*
    - With a fixed object*
    - With a moving object*
  - Direct*
    - With another athlete*
    - With a fixed object*

*With a moving object*

4. Type of injury

- New injury
- Subsequent recurrent injury
- Subsequent local injury
- Subsequent new injury

5. Injured body region

- Head and Neck
    - Head*
    - Neck*
  - Upper limb
    - Shoulder
    - Upper arm*
    - Elbow*
    - Forearm*
    - Wrist*
    - Hand*
  - Trunk
    - Chest*
    - Thoracic spine*
    - Lumbosacral*
    - Abdomen*
  - Lower limb
    - Hip/Groin*
    - Thigh*
    - Knee*
    - Lower leg*
    - Ankle*
    - Foot*
  - Unspecified
    - Region unspecified*
  - Multiple regions
-

- Single injury crossing two or more regions*

6. Tissue and pathology type for the injury

- Muscle/Tendon

- Muscle injury*
- Muscle contusion*
- Muscle compartment syndrome*
- Tendinopathy*
- Tendon rupture*

- Nervous

- Brain/Spinal cord injury*
- Peripheral nerve injury*

- Bone

- Fracture*
- Bone stress injury*
- Bone contusion*
- Avascular necrosis*
- Physis injury*

- Cartilage/Synovium/Bursa

- Cartilage injury*
- Arthritis*
- Synovitis/Capsulitis*
- Bursitis*

- Ligament/Joint capsule

- Joint sprain (ligament tear or acute instability episode)*
- Chronic instability*
- Contracture*

- Superficial tissues/skin

- Contusion (superficial)*
- Laceration*
- Abrasion*
- Pressure ulcer*

- Vascular trauma

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- Vessels*
- Residual limb
  - Residual limb*
- Internal organs
  - Organ trauma*
- Non-specific
  - Injury without tissue type specified*

7. Diagnosis and diagnosis code\*: \_\_\_\_\_

8. Involvement of adaptive equipment or the impairment

a. Did any adaptive equipment contribute to the injury?

- No
- Yes
- Unknown

*Describe how:* \_\_\_\_\_

b. Did the impairment per se contribute to the injury?

- No
- Yes

*Describe how* \_\_\_\_\_

- Unknown

9. Time loss from sport

Number of days lost: \_\_\_\_\_

10. Time loss category:

- 0 days
- 1-7 days
- 8-28 days
- >28 days

## Illness report form

1. Did the athlete/you report any illness that reduced the athlete's normal state of full health, irrespective of its consequences on the athlete's sports participation or performance or whether the athlete sought medical attention?

- No
- Yes
  - Directly from participation in training or competition*
  - Indirectly from participation in training or competition*
  - From an activity that is not related to sports participation*

2. Affected organ system/region

- Cardiovascular
  - Dermatological
    - Infectious pressure ulcer*
  - Dental
  - Endocrinological
  - Gastrointestinal
  - Genitourinary
  - Haematological
  - Musculoskeletal
    - Premature osteoporosis*
    - Infectious residual limb injury*
  - Neurological
    - Autonomic nervous system (i.e. autonomic dysreflexia)*
    - Central nervous system (i.e. seizure, hypertonia or neuropathic pain)*
    - Peripheral nervous system (i.e. phantom pain)*
  - Ophthalmological
  - Otological
  - Psychiatric/psychological
  - Respiratory
  - Thermoregulatory
  - Multiple systems
  - Unknown or not specified
-

3. Aetiology of illness

- Allergic
- Comorbidity of existing impairment
- Environmental—exercise-related
- Environmental—non-exercise
- Immunological/Inflammatory
- Infection
- Neoplasm
- Metabolic/nutritional
- Thrombotic/Haemorrhagic
- Degenerative or chronic condition
- Developmental anomaly
- Drug-related/Poisoning
- Multiple
- Unknown or not specified

4. Diagnosis and diagnosis code\*: \_\_\_\_\_

5. Time loss from sport

Number of days lost: \_\_\_\_\_

6. Time loss category

- 0 days
- 1-7 days
- 8-28 days
- >28 days

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\*Provide diagnosis and diagnosis code from the Orchard Sports Injury and Illness Classification System (OSIICS), the Sport Medicine Diagnostic Coding System (SMDSC), and the International Classification of Disease (ICD).



## References

- 1 Bahr R, Clarsen B, Derman W, *et al.* International Olympic Committee consensus statement: methods for recording and reporting of epidemiological data on injury and illness in sport 2020 (including STROBE Extension for Sport Injury and Illness Surveillance (STROBE-SIIS)). *Br J Sports Med* 2020;**54**:372–89. doi:10.1136/bjsports-2019-101969
- 2 Fagher K, Jacobsson J, Timpka T, *et al.* The sports-related injuries and illnesses in Paralympic sport study (SRIIPSS): a study protocol for a prospective longitudinal study. *BMC Sports Sci Med Rehabil* 2016;**8**. doi:10.1186/s13102-016-0053-x
- 3 Fagher K, Jacobsson J, Dahlström Ö, *et al.* An eHealth application of self-reported sports-related injuries and illnesses in Paralympic sport: pilot feasibility and usability study. *JMIR Hum Factors* 2017;**4**:e30
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### Appendix 3

#### Additional tables

**Table A.** Examples of mode of onset in Para athletes

<b>Mechanism</b>	<b>Presentation</b>	<b>Para translation</b>
<b>Acute</b>	<b>Sudden</b>	A Para snowboarder loses control, falls and collides with a safety netting pole, fracturing his tibia
<b>Repetitive</b>	<b>Sudden</b>	A single leg amputee sprinting for the finish line, suddenly falls and reports hearing a loud popping noise on her unaffected limb's side. Ultrasound reveals an acute Achilles tendon tear as well as long-standing Achilles tendinopathy
<b>Repetitive</b>	<b>Gradual</b>	A sitting volleyball player experiences a gradual increase in shoulder pain from chronic rotator-cuff tendinopathy

**Table B.** Recommended data collection categories of body regions and areas for injuries according to the IOC consensus and extended with body areas (stumps) that may be injured in amputee athletes.

<b>Region</b>	<b>Body area</b>
Head and neck	Head
	Neck
Upper limb	Shoulder
	Shoulder disarticulation
	Forequarter
	Upper arm
	Above elbow (transhumeral)
	Elbow
	Elbow disarticulation
	Forearm
	Below elbow (transradial)
	Wrist
	Wrist disarticulation
	Hand
	Partial hand (transcarpal)
Trunk	Chest
	Thoracic spine
	Lumbosacral
	Abdomen
Lower limb	Hip/groin
	Hemipelvectomy
	Hip disarticulation
	Thigh
	Above knee stump (transfemoral)
	Knee
	Knee disarticulation
	Lower leg
	Below knee stump (transtibial)
	Ankle
	Ankle disarticulation
	Foot
	Partial foot (Syme, Lisfranc, Chopart, transmetatarsal)
Unspecified	Region unspecified
Multiple regions	Single injury crossing two or more regions

**Table C.** Practical examples of how to calculate time loss

<i>Case</i>	<i>Time loss (days)</i>
A Para triathlete interrupts a training session due to a single episode of vomiting and returns to normal training the following day.	0
A wheelchair rugby player sustains a finger dislocation catching the ball. X-rays reveal a dislocated interphalangeal joint; the athlete agrees to having the finger reduced and strapped, and competes later that day.	0
'Intermittent' time loss: a track and field athlete with cerebral palsy hemiplegia reports an Achilles tendinopathy at the start of a training camp on Saturday. The Para athlete can train fully on Saturday, Sunday and Tuesday, but misses training on Monday and Wednesday (time loss counted as Monday and Wednesday only).	2
'Delayed' time loss: a visually impaired judoka sustains a quadriceps contusion on Saturday and is able to train on Sunday and Monday, unable to train on Tuesday, Wednesday and Thursday, but returns to training on Friday (time loss counted as Tuesday, Wednesday and Thursday).	3
A boccia player with cerebral palsy develops pneumonia during a competition and starts oral antibiotics. The Para athlete continues to compete, but two days later develops systemic symptoms and requires intravenous antibiotics in hospital. After two days hospital inpatient treatment the Para athlete is discharged home and takes 20 days to make a full recovery and be cleared by the general practitioner to start training again.	22
A visually impaired (blind) footballer sustains a head injury and is diagnosed with concussion. The team physician assesses the Para athlete to have returned to baseline after 15 days. The athlete is advised to commence a 'standard care setting graduated return to play' over the next 14 days after the footballer returns home from the tournament, before being cleared by the physician to commence full training/competition.	29
A Para alpine skier with one functioning arm falls and sustains mid-shaft fractures to their radius, ulnar and scaphoid, which require a total of 56 days in a cast. The orthopaedic surgeon recommends the Para athlete can safely return to training 10 weeks after removal of the cast with some additional protection. The skier becomes dependent on care with no functioning arms and struggles to access physiotherapy, not being able to get to the hospital and are left with persistent residual wrist stiffness. It takes 160 days for the Para athlete to get back to training after cast removal.	216

**Table D.** Recommendations for Para sport-specific exposure measures

<b>Para sports (as per IPC)</b>	<b>Competition exposure measure(s)</b>	<b>Time exposure</b>
Alpine Skiing	# of races	Minutes
Archery	# of shots	Hours
Athletics	# of competitions # of rounds Distance covered	Minutes
Badminton	# of matches	Hours
Boccia	# of shots	Hours
Canoe	Distance covered	Hours
Cycling		
Road Cycling	Distance covered	Hours
Track Cycling	# of races Distance covered	Minutes/Hours
Equestrian	# of rides	Minutes/Hours
Football 5 a side	# of matches	Hours
Goalball	# of matches	Hours
Judo	# of matches # of bouts/fights	Minutes
Nordic Skiing	Distance covered	Hours
Para Ice Hockey	# of matches	Hours
Powerlifting	# of lifts # of rounds	Minutes
Rowing	Distance covered	Hours
Shooting	# of shots	Hours

Sitting Volleyball	# of matches	Hours
Snowboard	# of races	Minutes
Swimming	Distance covered	Hours
Table Tennis	# of matches	Hours
Taekwondo	# of matches # of bouts/fights	Minutes
Triathlon	Distance covered (separately for the 3 disciplines)	Hours
Wheelchair Basketball	# of matches	Hours
Wheelchair Curling	# of matches	Hours
Wheelchair Fencing	# of matches # of bouts/fights	Minutes
Wheelchair Rugby	# of matches	Hours
Wheelchair Tennis	# of matches, sets, or games	Hours