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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))

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ABSTRACT

Injury and illness surveillance, and epidemiological studies, are fundamental elements of concerted efforts to protect the health of the athlete. To encourage consistency in the definitions and methodology used, and to enable data across studies to be compared, research groups have published 11 sport-specific or setting-specific consensus statements on sports injury (and, eventually, illness) epidemiology to date. Our objective was to further strengthen consistency in data collection, injury definitions and research reporting through an updated set of recommendations for sports injury and illness studies, including a new Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist extension. The IOC invited a working group of international experts to review relevant literature and provide recommendations. The procedure included an open online survey, several stages of text drafting and consultation by working groups and a 3-day consensus meeting in October 2019. This statement includes recommendations for data collection and research reporting covering key components: defining and classifying health problems; severity of health problems; capturing and reporting athlete exposure; expressing risk; burden of health problems; study population characteristics and data collection methods. Based on these, we also developed a new reporting guideline as a STROBE Extension—the STROBE Sports Injury and Illness Surveillance (STROBE-SIIS). The IOC encourages ongoing in- and out-of-competition surveillance programmes and studies to describe injury and illness trends and patterns, understand their causes and develop measures to protect the health of the athlete. Implementation of the methods outlined in this statement will advance consistency in data collection and research reporting.

INTRODUCTION

Injury and illness surveillance, and epidemiological studies are fundamental elements of concerted efforts to protect the health of the athlete. Carefully designed injury surveillance programmes,

accurate data capture and careful analysis of data are building blocks for sports injury/illness prevention programmes. Important questions that sports injury and illness surveillance projects are designed to address include: What is the risk of an individual athlete sustaining an acute injury, developing an overuse injury or becoming ill in a given sport? Within a given sport, what is the typical pattern and severity of injuries and illnesses? How do injury rates in various sports compare? Do participant characteristics and factors within competition and training affect risk?

To encourage consistency in the definitions and methods used, and to enable data across studies to be compared, research teams have published 11 consensus papers on sports injury (and, eventually, illness) epidemiology. Most of them addressed specific sports—cricket,¹ football,² rugby union,³ rugby league,⁴ aquatic sports,⁵ tennis,⁶ athletics⁷ and horse racing.⁸ Two statements covered multisport events⁹ and mass-participation events (eg, marathon races).¹⁰

We now have more than a decade of experience with the existing recommendations. Sports epidemiology has advanced—with a new focus on overuse injuries and also on illnesses. Data collection and reporting methods have also advanced as data are being collected for routine surveillance or predefined observational or intervention studies in diverse settings, ranging from community to elite sports, from youth sports to the master's level, in able-bodied and athletes with disabilities and in team sports and individual sports. In 2005, when the first of these sports injury surveillance consensus statements was developed, there were no agreed on research reporting methods (eg, the EQUATOR Network was just holding its inaugural meeting). Many important research epidemiological issues

were not discussed in any of the previous sport-related consensus statements.

In 2019, the IOC convened an expert panel to update recommendations for the field of sports epidemiology—this consensus statement. We drew on recent methods developments and the experience of scientists working in the field of sports injury and illness surveillance. A specific goal was to further encourage consistency in data collection, injury definitions and research reporting (in line, where possible, with the EQUATOR network recommendations). Our aim was to provide hands-on guidance to researchers on how to plan and conduct data collection and how to report data. We anticipate that this sports-generic statement will be complemented by subsequent sport-specific statements with more detailed recommendations relevant for the sports and/or setting. We also extended the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist,¹¹ the STROBE-Sport Injury and Illness Surveillance (STROBE-SIIS), to assist users in planning surveillance studies, and in writing papers based on injury/illness data.

METHODS

This was an eight-stage process: (1) an online survey; (2) working groups reviewed the survey responses, available literature and drafted text; (3) all consensus group members reviewed the draft text; (4) the initial working groups revised their draft text; (5) a 3-day consensus meeting was held in Lausanne, Switzerland (9–11 October 2019); (6) new working groups revised the draft text; (7) an editorial group (RB, KC, BR, KMK) made final edits; (8) all authors reviewed and approved the final draft.

The IOC Medical and Scientific Department appointed RB to chair the consensus group. He selected a consensus group that included at least one author from previous consensus statements on sports injury epidemiology. Care was taken to include experts with research experience from diverse settings (sports types, age groups, performance levels) and with a variety of health problems as outcomes (eg, illness, not only acute injuries).

1. Online survey: the survey included 25 questions inviting free-text comments on aspects identified from previous consensus statements. The survey link was open to the public and was launched via email and Twitter on 1 February 2019 and closed on 15 March 2019. We received comments from 188 respondents, including 19 consensus group members. A report including all responses was distributed to the consensus group on 31 August 2019.
2. The consensus group was split into seven working groups. Each working group was responsible for a subset of the sections presented in this final document (eg, 'classifying health problems'). For each section, the group reviewed the survey responses, examined available relevant literature (including previous consensus statements) and composed draft text with necessary background and proposed definitions and recommendations.
3. RB created a complete draft which was shared online with the consensus group, asking all members to provide written comments/suggestions. Comments were made online and visible to all group members.
4. The working groups revised their sections based on input from other members of the consensus group.
5. At the in-person consensus meeting, attended by all consensus group members, the revised draft was discussed section by section, focusing on recommendations and definitions.
6. Seven new revision groups made up of those not responsible for drafting the original section under discussion were re-

sponsible for taking notes and revising the text. If necessary, items were voted on to achieve a majority.

7. The revised draft was edited for consistency and form by RB and reviewed with the rest of the editorial group (KC, BR, KMK).
8. Finally, the manuscript was distributed to the consensus group members for final approval.

DEFINING AND CLASSIFYING HEALTH PROBLEMS

Terminology for health problems

WHO defines health as 'a state of complete physical, mental and social well-being' and not merely the absence of disease or infirmity.¹² Extending this definition, Clarsen *et al*¹³ defined an athletic health problem as any condition that reduces an 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. This constitutes an umbrella term that includes, but is not limited to, injury and illness.

Health problems can have several consequences. A health problem that results in an athlete receiving medical attention is referred to as a 'medical attention' health problem, and a health problem that results in a player being unable to complete the current or future training session or competition as a 'time-loss' health problems.^{1 3–5 7 14} As not all health problems limit an athlete's ability to participate nor require medical attention, broader definitions (self-reported, symptom-based or performance-based) will capture more health problems. Figure 1 illustrates these differences.

Defining injury and illness

Previous consensus statements on injury and illness in sport have proposed largely consistent definitions for injury and illness.^{1 3 5–10 14 15} Differences in definition stem from the specific sport or context for which statements were developed. For this consensus statement, we define injury and illness as follows:

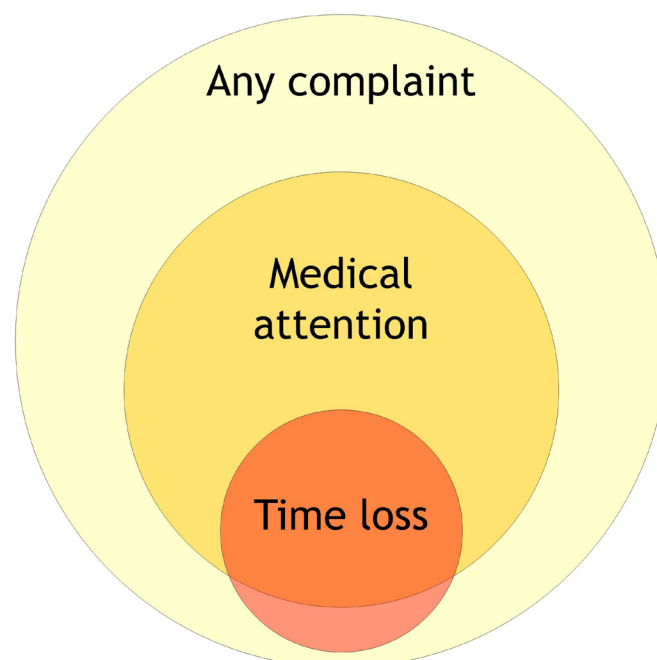


Figure 1 Distribution of health problems by consequences (not to scale). Adapted from Clarsen and Bahr.⁸⁴

Injury is tissue damage or other derangement of normal physical function due to participation in sports, resulting from rapid or repetitive transfer of kinetic energy.

Illness is a complaint or disorder experienced by an athlete, not related to injury. Illnesses include health-related problems in physical (eg, influenza), mental (eg, depression) or social well-being, or removal or loss of vital elements (air, water, warmth).

We acknowledge that there is not always a clear distinction between injury and illness. The consensus was that for injury, the primary mode involves transfer of kinetic energy, but other types of injury, such as sunburn or drowning, may have a different aetiology.

These definitions are meant to be inclusive; they embrace a broad array of injury-related and illness-related health problems that may affect an athlete. Depending on the goal of the monitoring activity, data recording may be limited to specific health problems that constitute a narrower subset of the above definitions (ie, via an operational definition). If the surveillance programme has a narrow scope (eg, to capture only concussions in school rugby), data recording can be limited to the specific injury type of interest.

Relationship to sports activity

Health problems may result:

1. *directly* from participation in competition or from training in the fundamental skills of a sport (eg, players colliding in a match, overuse from repetitive training or transmission of a skin infection from contact with another player);
2. *indirectly* from participation in activities that related to competition or training in a sport, but not during competition or a training session (eg, slipping, falling and sustaining an injury when in the Olympic 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);
3. from activities that are *not at all related to participation in sport*, that is, would occur in the absence of participation during competition or training in the fundamental skills of a sport (eg, car crash, sudden cardiac arrest at home).

Depending on the purposes of the study, researchers may want to report health problems in these categories separately.

Mode of onset

Traditionally, health problems have been classified into those that have a sudden onset and those that have a gradual onset. Sudden-onset health problems were considered to be those that resulted from a specific identifiable event (eg, a collision between an athlete and an object causing a fracture). Gradual-onset problems, on the other hand, were considered to be those that lack a definable sudden, precipitating event as the onset (eg, a tendinopathy induced by repetitive movement).

The term 'overuse injury' is commonly applied to gradual-onset injuries. However, this term is used inconsistently in the literature^{16 17} and most injury surveillance systems do not define 'overuse injury'.¹⁶

Health problems may have elements of both sudden onset and gradual onset. For example, a long-distance runner with an intensive training regime may have insufficient recovery, resulting in cumulative stress-related changes to the bone, but presenting as an acute tibia fracture without prior pain. The dichotomy between sudden onset and gradual onset, which most methods of data capture are based on, means such important nuances may be missed. One option to address this problem would be to classify health problems based on the underlying pathology,

whether this indicates a single or repetitive pathogenic mechanism, based on imaging studies (eg, MRI, ultrasound) or tissue biopsies. However, routine capture of such detail in a reliable manner within a surveillance system is challenging.

Mode of onset—*injury*

For injuries, classical epidemiology provides a solution for this issue by viewing health problems as the result of a series of interactions between agent, host and environment.^{18 19} Injury epidemiology adapted this model by defining kinetic energy as the 'agent' of injury.^{20–22}

In this paradigm, following the definition above, injury results from a transfer of kinetic energy (agent) that damages tissue. Injury may result from a near-instantaneous exchange of large quantities of kinetic energy (eg, as in a collision between athletes), from the gradual accumulation of low-energy transfer over time (as in the bone stress injury example) or from a combination of both mechanisms (repetitive training regime resulting in tendon weakness that then manifests itself acutely as a tear from acceleration forces applied during a single jump). This model suggests mode of onset for injuries should be conceptualised as a continuum interplay of energy exposures.

Mode of onset—*illness*

Illnesses, like injuries, may be either associated with a specific precipitating event (eg, a player ingesting a toxin from food and suffering gastrointestinal illness that manifests within hours of exposure) or they may involve a progressive pathway that cannot be linked to a specific precipitating event (eg, progressive fatigue from increased training load). Similarly, the timescale for sudden-onset illness can be seconds and minutes (eg, acute anaphylaxis) or develop within hours after exposure to a pathogen or a toxin (eg, gastroenteritis) or even days or weeks (eg, upper respiratory tract infection).

The mode of onset for illnesses may also be related to a specific event, with or without some underlying subclinical pathology. For example, myalgic encephalomyelitis will typically present without a precipitating event, whereas influenza usually has a point source of exposure (although this may be difficult to trace). As with injuries, many illnesses reflect both underlying pathology and a sudden-onset event (eg, an athlete may be predisposed to bronchial hyper-reactivity, and this may present acutely as bronchoconstriction when exposed to air pollution at a venue).

Classifying mode of onset

We recommend that injury/illness surveillance discontinue use of sudden onset and gradual onset as a simple dichotomy and implement methods that capture relevant subtleties. We encourage researchers to develop and use measures that will help identify injuries and illnesses that involve mixed acute and repetitive mechanisms. Data collectors should consider whether a health problem results from a clear acute mechanism, clear repetitive mechanism or appears to include a mix of both elements (table 1). Examples 1 and 3 in table 1 reflect clear acute and repetitive aetiology, respectively, whereas example 2 represents a mixed aetiology.

Classifying the mechanism of injury

Mechanism of onset has typically been defined only in the context of sudden-onset injuries. Sudden-onset health problems can result from contact and non-contact mechanisms; this classification is discussed below and presented in table 2.

Table 1 Examples: assessment of mode of onset

Mechanism	Presentation	Example
Acute	Sudden onset	(1) A sprinter pulls up suddenly in a race, stops and hobbles a few steps in obvious pain with a hamstring injury.
Repetitive	Sudden onset	(2) A gymnast experiences a frank tibial and fibular fracture on landing from a vault; CT imaging reveals pre-existing morphological changes consistent with bone stress, that is, a stress fracture.
Repetitive	Gradual onset	(3) A swimmer experiences gradual increase in shoulder pain over the course of a season; diagnosed as rotator cuff tendinopathy on MRI.

Direct contact mechanisms directly lead to the health problem in an immediate and proximal manner.

Indirect contact mechanisms also stem from contact with other athletes or an object. The force is not applied directly to the injured area, but contributes to the causal chain leading to the health problem.^{23–26}

Non-contact mechanisms are those that lead to health problems without any direct or indirect contact from another external source. Gradual-onset injuries, by their nature, are non-contact.

We anticipate that subsequent sport-specific consensus statements will provide more detailed subclassifications to address specific features of contact mechanisms (eg, subclassification of contact with objects, such as ball, bat, net, gate). Future sport-specific statements may also give specific recommendations on other categories for classification related to injury causation (eg, rule infringements, particular movements or other sport-specific features). The International Classification of Disease (ICD) External Causes Chapter²⁷ and the International Classification of External Causes of Injury²⁸ provide specific codes that might be useful.

Multiple events and health problems

One of the particular features of sports epidemiology, compared with other settings, is the relatively high chance that an athlete will sustain more than one health problem over the follow-up period. This is illustrated in figure 2.

The relatively common occurrence of multiple health problems in a single individual poses challenges for the reporting and analysis of sports injury and illness data.²⁹ In particular, note

Table 2 Examples: classification of contact as a mechanism for sudden-onset injury

Injury	Type of contact	Examples
Non-contact	None	No evidence of disruption or perturbation of the player's movement pattern ACL tear in a basketball player landing with knee valgus/rotation after a jump, with no contact with other players.
Contact	Indirect	Through another athlete ACL tear in a handball player landing, out of balance after being pushed on her shoulder by an opponent while in the air.
	Indirect	Through an object Downhill skier suffers a concussion from a crash, after being knocked off balance hitting the gate with his knee.
Contact	Direct	With another athlete ACL tear in a football player from a direct tackle to the anterior aspect of the knee, forcing the knee into hyperextension.
	Direct	With an object Volleyball player being hit in the face by a spiked ball, resulting in a concussion.

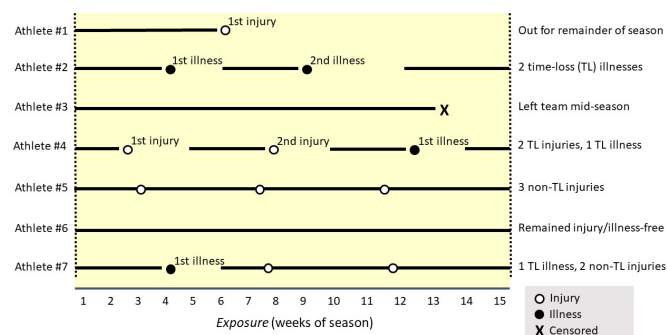


Figure 2 Examples of hypothetical prospectively collected injury/illness data (adapted from Finch and Marshall).¹¹⁴ The X indicates when a period of surveillance is ended because the athlete left, unrelated to health problems, before the end of the study period; this is called censoring.

that the number of athletes in a study is unlikely to be the same as the number of reported health conditions and both should be stated. When reporting the frequency (or proportion) of specific diagnoses or other characteristics, it is important to state clearly whether this is expressed as the proportion of all athletes followed up or the proportion of all injured athletes or the proportion of all reported injuries.

Subsequent, recurrent and/or exacerbation of health problems

Was a subsequent health problem related to previous health problems? This is an important question in the field. To know whether health problems follow previous health problems requires both sets of problems to be classified correctly using consistent terminology. This exercise can provide greater insight into the etiological factors that underpin subsequent health problems.³⁰

Hamilton *et al*³¹ provided a useful framework to categorise subsequent injuries/illnesses and exacerbations in sport (figure 3). More recent frameworks incorporate extensive criteria^{30 32 33} that require judgement by trained clinicians, which may be beyond the scope and capacity of many surveillance protocols. When reporting frameworks become more complex, there is a greater risk of data errors.³⁴ In general, we do not recommend complex frameworks but they can be considered for sophisticated data collection and analysis where appropriate expertise and resources exist.

The recommended subsequent injury terminology, adapted from Hamilton *et al*,³¹ includes noting whether subsequent injuries: (i) affect the same site but other tissues (eg, knee but meniscus instead of ACL alone) or (ii) affect other sites. Subsequent illness terminology³¹ notes whether the subsequent illnesses is the same system (eg, respiratory) but other diagnosis (eg, bronchospasm as distinct from a viral illness) or to other systems. The relevant definitions are shown in figure 3. Note that an injury may be subsequent to an illness and vice versa (eg, bones stress injury following diagnosis of an eating disorder, depression following a lengthy recovery after revision ACL reconstruction).

Subsequent injuries to the same location and tissue as the index injury are *recurrences* if the index injury was healed/fully recovered; they are *exacerbations* if the index injury was not yet healed/fully recovered. Subsequent illnesses to the same system and type as the index illness are *recurrences* if the individual has fully recovered from the index illness, and *exacerbations* if the individual has not yet recovered from the index illness.

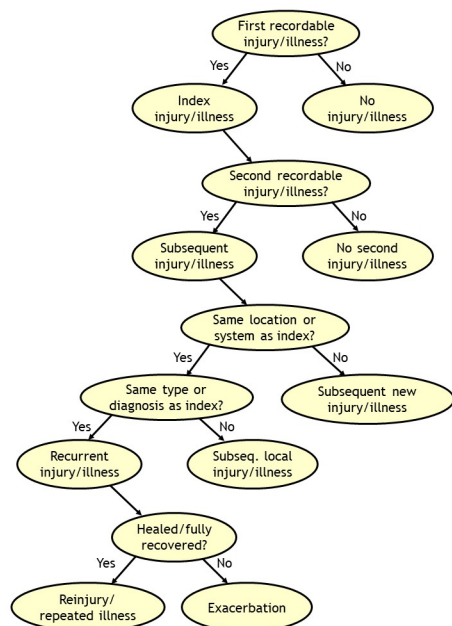


Figure 3 Classification tree for subsequent health problems (adapted from Hamilton *et al*³¹). Definitions: (1) index injury (illness)=the first recorded injury (illness), (2) subsequent injury (illness)=any injury (illness) occurring after the index injury (illness) (i) subsequent injury to a different location than the index injury (subsequent illness involving a different system than the index illness); (ii) subsequent injury to the same location but of a different tissue type than the index injury (subsequent illness of involving the same system but of a different type/other diagnosis) or (iii) subsequent recurrent injury (illness)=subsequent injury to the same site and of the same type as the index injury (subsequent illness involving the same system and type as the index illness). Third, fourth or more health problems should be assessed relative to the initial index health problem and all other previous ones (eg, second and third health problem).

Healed/fully recovered from injury (or illness) is defined as when the athlete is fully available for training and competition (see 'Severity of health problems' section).

To illustrate how to classify subsequent injury, consider athlete 'A' who, following an ACL rupture and surgical reconstruction, presents late in the rehabilitation period, before return to play, with swelling and pain in the knee after a slip and fall injury resulting in a graft tear. This injury would be classified as an *exacerbation* of the index injury. In contrast, athlete 'B' rehabilitated successfully after an ACL reconstruction and returned to play; that player presents with pain and swelling in the same knee. If the diagnosis is a torn ACL graft, this would be classified as a *recurrent injury*. If the diagnosis is a meniscal tear (ACL graft intact), this is a local *subsequent injury*.

To illustrate how to classify subsequent illness, consider athlete 'C' who has withdrawn from sports participation due to an upper respiratory tract infection caused by influenza type A virus, which then progresses to a lower respiratory tract infection resulting in a diagnosis of viral pneumonia. As athlete 'C' is diagnosed with pneumonia before recovery and return to play, the diagnosis of pneumonia is an *exacerbation* of a recurrent illness. In contrast, athlete 'D', following full recovery from the upper respiratory tract infection and return to play, is diagnosed with pneumonia; this illness is a *subsequent new illness*.

Time to recurrence or exacerbation should be recorded in days (see 'Severity of health problems' section).

Table 3 Recommendations for key data items that should be collected and reported on in surveillance systems to enable multiple and subsequent injuries/illnesses to be monitored (modified from Finch and Fortington¹¹⁵)

Data items	Why it is important
1. Unique identifier to link all injuries/illnesses in one participant	All participants require a unique identifier that covers all seasons/time periods and should be anonymised to protect privacy and confidentiality.
2. The injury/illness time order sequence	The exact date (day, month, year) of onset for each health problem is essential for the sequence to be clear. For greater precision, time can be important if multiple events/heats each day (eg, swimming).
3. Multiple injury/illness type details	Multiple injuries and illnesses can be the result of different or same event or aetiology, coincide at the same time or a mixture of both. Injuries/illnesses need to be linked to the specific circumstances/events that led to them. Date and time stamping, directly linked to diagnoses of all injuries/illnesses can inform these relationships.
4. Injury/illness details, including diagnosis	Collect information on the nature, body region/system, tissue/organ, laterality and diagnosis for all injuries/illnesses. Sport injury/illness diagnostic classification and coding is optimal.
5. Details of circumstances and time elapsed between	The time elapsed between injuries/illnesses will be determined by date and time stamping. If away from participation in sport then it is important to collect details and date/time stamps regarding rest, rehabilitation, treatment, training, modified sport participation and return to play.

A minimum list of data items recommended when collecting information on subsequent injury or illness is shown in table 3.

Classifying sports injury and illness diagnoses

Injury and illness classification systems are used in sports medicine to:

1. Accurately classify and group diagnoses for research or reporting, allowing easy grouping into parent classifications for summary, so that injury and illness trends can be monitored over time or injury or illness incidence or prevalence can be compared between groups (eg, different teams, leagues, sports, sexes), potentially leading to risk factor and preventive studies.
2. Create databases from which cases can be extracted for research on particular or specific types of injuries and illnesses.

In the late 1980s, clinicians and researchers were using the ninth edition of the ICD.²⁷ The ICD system is an important international standard, yet even the 11th edition, released in 2018, lacks some classifications important in sports injury and illness surveillance. Hamstring strain and exercise-associated postural hypotension are two examples.^{35–37} We encourage developers to include more sports medicine diagnoses in future revisions of the ICD.

In the early 1990s, in Canada and Australia, two alternate diagnostic coding systems were developed specifically for sports medicine and these have flourished into the most widely used systems in sports injury surveillance in the world today. Their 'open access' nature has allowed other researchers to use them free of charge (with acknowledgement). These diagnostic coding systems are the Sport Medicine Diagnostic Coding System (SMDCS) and the Orchard Sports Injury Classification System (OSICS). Both are based on initial codes to represent body area and further codes to represent injury type or pathology.

One advantage of these coding systems is that they are less cumbersome to apply than ICD codes, especially when built into electronic systems with drop-down menus taking advantage of the body area and tissue-type/pathology-type categories. The full ICD-11 coding system includes 55 000 codes, of which the

Table 4 Recommended categories of body regions and areas for injuries

Region	Body area	OSIICS	SMDCS	Notes
Head and neck	Head	H	HE	Includes facial, brain (concussion), eyes, ears, teeth.
	Neck	N	NE	Includes cervical spine, larynx, major vessels.
Upper limb	Shoulder	S	SH	Includes clavicle, scapula, rotator cuff, biceps tendon origin.
	Upper arm	U	AR	
	Elbow	E	EL	Ligaments, insertional biceps and triceps tendon.
	Forearm	R	FA	Includes non-articular radius and ulna injuries.
	Wrist	W	WR	Carpus.
	Hand	P	HA	Includes finger, thumb.
Trunk	Chest	C	CH	Sternum, ribs, breast, chest organs.
	Thoracic spine	D	TS	Thoracic spine, costovertebral joints.
	Lumbosacral	L	LS	Includes lumbar spine, sacroiliac joints, sacrum, coccyx, buttocks.
	Abdomen	O	AB	Below diaphragm and above inguinal canal, includes abdominal organs.
Lower limb	Hip/groin	G	HI	Hip and anterior musculoskeletal structures (eg, pubic symphysis, proximal adductors, iliopsoas). ¹¹⁶
	Thigh	T	TH	Includes femur, hamstrings (including ischial tuberosity), quadriceps, mid-distal adductors.
	Knee	K	KN	Includes patella, patellar tendon, pes anserinus.
	Lower leg	Q	LE	Includes non-articular tibia and fibular injuries, calf and Achilles tendon.
	Ankle	A	AN	Includes syndesmosis, talocrural and subtalar joints.
	Foot	F	FO	Includes toes, calcaneus, plantar fascia.
Unspecified	Region unspecified	Z	OO	
Multiple regions	Single injury crossing two or more regions	X	OO	

OSIICS, Orchard Sports Injury and Illness Classification System; SMDCS, Sport Medicine Diagnostic Coding System.

majority are not relevant in sports medicine, compared with 750–1500 codes for versions of the SMDCS and OSICS.

When reporting aggregate injury data, we recommend using the categories for body areas (table 4) and tissue types and pathologies (table 5) outlined below. Table 6 illustrates how injury data can be reported using these categories. In addition, categories for organ system/region (table 7) and aetiology (table 8) are presented below for illnesses.

When recording injuries or illnesses, the diagnosis should be recorded in as much detail as possible given the information available and the expertise of the individual reporting. Acknowledging that some studies will rely on athlete self-report, or proxy report by parents, coaches or other non-medically trained staff, this consensus group also suggest categories to guide reporting of illnesses (table 9). When injury data are reported by athletes or non-medical staff, we recommend that reporting is limited to body area, as their reporting of tissue type and pathology is unreliable.³⁸

To facilitate reporting based on diagnostic codes, a companion paper has been written with a supplemental Excel data file that provides a full list of revised SMDCS and OSIICS (Orchard Sports Injury and Illness Classification System) codes, along with a translation between both systems and the ICD system.³⁹

Injuries—body area categories

Wherever possible, we tried to define body areas anatomically as either joints or segments. However, we made exceptions based on common clinical presentations in sport where needed. For example, hip/groin is an area we have defined, which is a combination of joint and part of a segment, and therefore not a singular anatomical region.

When one injury event results in more than one injury, the individual diagnoses should be recorded and classified separately. However, for injury incidence and prevalence reporting

purposes this will be counted as one injury, and severity should be reported as the severity of the principal (most severe) injury (see below for further explanation).

Injuries—tissue-type and pathology-type categories

Using consensus methodology, we compared the ‘injury-type’ codes from the OSICS and SMDCS systems to arrive at definitions of injury types. We constructed this table to be a single table reflecting ‘injury types’ (as per OSICS) but split two columns into ‘tissue’ (as the broad area) and then ‘pathology’ type more specifically. This reflects the original approach taken in the SMDCS.

Recommendations: reporting injury characteristics

Injury characteristics are often reported in one table by region, one by injury type or both. Cross-tabulations depicting data by region *and* injury type, that is, combining the two into one table, often become large and unwieldy. It can leave many cells empty or with very few cases (which can then compromise confidentiality), unless the dataset is unusually large. Such tables often also provide insufficient information for research focused on specific areas or sports. For example, in a sport where knee sprains dominate, it may be desirable to report subgroups of these (eg, ACL, medial collateral ligament) at greater detail.

In many cases, a better reporting option is to combine region *and* type *and* diagnosis in one table such as in the example shown in table 6, where some categories have been collapsed at the level of body region (bold), some regions have been split further into injury types (subheader) and some even at the level of specific diagnosis (italics). It is expected that subsequent consensus statements on specific sports will provide recommendations on suitable, standard formats for each sport, to facilitate direct

Consensus statement

Table 5 Recommended categories of tissue and pathology types for injuries

Tissue	Pathology type	OSIICS	SMDCS	Notes
Muscle/Tendon	Muscle injury	M	10.07–10.09	Includes strain, tear, rupture, intramuscular tendon.
	Muscle contusion	H	10.24	
	Muscle compartment syndrome	Y	10.36	
	Tendinopathy	T	10.28–10.29	Includes paratenon, related bursa, fasciopathy, partial tear, tendon subluxation (all non-rupture), enthesopathy.
	Tendon rupture	R	10.09	Complete/full-thickness injury; partial tendon injuries considered to be tendinopathy.
Nervous	Brain/Spinal cord injury	N	20.40	Includes concussion and all forms of brain injury and spinal cord.
	Peripheral nerve Injury	N	20.39, 20.41–20.42	Includes neuroma.
Bone	Fracture	F	30.13–30.16, 30.19	Traumatic, includes avulsion fracture, teeth.
	Bone stress injury	S	30.18, 30.32	Includes bone marrow oedema, stress fracture, periostitis.
	Bone contusion	J	30.24	Acute bony traumatic injury without fracture. Osteochondral injuries are considered 'joint cartilage'.
	Avascular necrosis	E	30.35	
	Physis injury	G	30.20	Includes apophysis.
Cartilage/Synovium/Bursa	Cartilage injury	C	40.17, 40.21, 40.37	Includes meniscal, labral injuries and articular cartilage, osteochondral injuries.
	Arthritis	A	40.33–40.34	Post-traumatic osteoarthritis.
	Synovitis/Capsulitis	Q	40.22, 40.34	Includes joint impingement.
	Bursitis	B	40.31	Includes calcific bursitis, traumatic bursitis.
Ligament/Joint capsule	Joint sprain (ligament tear or acute instability episode)	L or D	50.01–50.11	Includes partial and complete tears plus injuries to non-specific ligaments and joint capsule; includes joint dislocations/subluxations.
	Chronic instability	U	50.12	
Superficial tissues/skin	Contusion (superficial)	V	60.24	Contusion, bruise, vascular damage.
	Laceration	K	60.25	
	Abrasion	I	60.26–60.27	
Vessels	Vascular trauma	V	70.45	
Stump	Stump injury	W	91.44	In amputees.
Internal organs	Organ trauma	O	80.46	Includes trauma to any organ (excluding concussion), drowning, relevant for all specialised organs not mentioned elsewhere (lungs, abdominal and pelvic organs, thyroid, breast).
Non-specific	Injury without tissue type specified	P or Z	00.00 (also 00.23, 00.38, 00.42)	No specific tissue pathology diagnosed.

OSIICS, Orchard Sports Injury and Illness Classification System; SMDCS, Sport Medicine Diagnostic Coding System.

comparison of data on key injury types from studies on the same sport.

Illness—categories for organ system and aetiology

Illness consensus categories are presented in [tables 7 and 8](#). These are more detailed than the original versions of the SMDCS and OSIICS. Our tables diverge from the ICD categorisation format, in which body systems and pathology types are grouped together. We believe that it is important to recognise that an illness, like an injury, affects both a body system and has a specific pathological type. A respiratory infection does not need to be considered either only as a respiratory condition or an infection, it is certainly both. Our recommended illness systems are similar to many of those in the ICD, but we have merged some systems, such as the upper respiratory system and nose/throat.

The professional background of those who report health data will influence the final data quality (see 'Data collection methods' section).⁴⁰ When athletes themselves (or non-clinical recorders like coaching staff) are asked to capture illness data, they should be encouraged to record symptoms rather than attempt a diagnosis. [Table 9](#) lists symptom clusters that are characteristic of various systems. We caution that this table requires additional validation and may be modified in future. Mapping symptoms to bodily systems sacrifices some accuracy; however,

in circumstances where expert recorders are unavailable, it is better to have general systems diagnosis data than no data at all.

Recommendations: reporting illness characteristics

As was the case when we discussed reporting of injury data, we recommend against illness data being reported as cross-tabulations of organ system by aetiology type. A better option is to combine system/region and aetiology in one table, as in the example on injuries shown in [table 6](#). Depending on the illness pattern of the sport/setting, some region categories may be collapsed, others split further into aetiology type and even to the level of specific diagnosis (where available), to highlight the most significant illnesses. We expect that subsequent sport-specific consensus statements will recommend useful standard formats for each sport.

SEVERITY OF HEALTH PROBLEMS

The severity of health problems in sport can be described using various criteria.^{41–43} These include the duration of the period for which an athlete is unable to train/play (called 'time loss'), the athlete's self-reported consequences (various patient-rated measures of both health and sports performance), the clinical extent of illness/injury and societal cost (economic evaluation).

Table 6 Data on the injury pattern and burden of specific match injuries among professional rugby teams in New Zealand (2005–2018, unpublished data).

Region	Injuries	Incidence	Median time loss	Burden
Type	n	Injuries per 1000 hours (95% CI)	Days (95% CI)	Time loss days per 1000 hours (95% CI)
<i>Diagnosis</i>				
Head	277	12.9 (11.5 to 14.5)	9 (8 to 10)	325 (317 to 333)
<i>Concussion</i>	204	9.5 (8.3 to 10.9)	10 (9 to 11)	257 (250 to 263)
Neck	60	2.8 (2.2 to 3.6)	8 (6 to 10)	135 (130 to 140)
Shoulder	168	7.8 (6.7 to 9.1)	21 (14 to 27)	628 (618 to 639)
Acute dislocation	15	0.7 (0.4 to 1.1)	209 (27 to 337)	165 (159 to 170)
Haematoma	18	0.8 (0.5 to 1.3)	8 (4 to 13)	25 (23 to 27)
Joint sprain	102	4.8 (3.9 to 5.7)	19 (12 to 25)	292 (285 to 300)
<i>Acromioclavicular joint sprain</i>	54	2.5 (1.9 to 3.3)	14 (10 to 20)	68 (65 to 72)
<i>Glenohumeral joint sprain</i>	48	2.2 (1.7 to 2.9)	30 (14 to 80)	225 (218 to 231)
Upper arm	4	0.2 (0.1 to 0.4)	6 (3 to 133)	7 (6 to 8)
Elbow	27	1.3 (0.9 to 1.8)	9 (5 to 17)	42 (39 to 44)
Forearm	10	0.5 (0.2 to 0.8)	99 (44 to 131)	65 (61 to 68)
Wrist and hand	96	4.5 (3.6 to 5.4)	10 (7 to 27)	194 (188 to 200)
Chest	81	3.8 (3.0 to 4.7)	13 (10 to 16)	75 (71 to 79)
Thoracic spine	6	0.3 (0.1 to 0.6)	5 (3 to 50)	5 (4 to 6)
Lumbar spine	32	1.5 (1.0 to 2.1)	10 (5 to 21)	66 (63 to 70)
Pelvis/Buttock (excluding groin)	6	0.3 (0.1 to 0.6)	12 (5 to 20)	3 (3 to 4)
Hip/Groin	40	1.9 (1.4 to 2.5)	9 (6 to 11)	82 (78 to 86)
Thigh	138	6.4 (5.4 to 7.6)	14 (11 to 17)	171 (165 to 176)
Knee	165	7.7 (6.6 to 8.9)	31 (23 to 37)	544 (535 to 554)
Knee cartilage injury	29	1.4 (0.9 to 1.9)	43 (29 to 58)	124 (120 to 129)
<i>Meniscal cartilage injury</i>	22	1.0 (0.7 to 1.5)	44 (28 to 62)	101 (96 to 105)
Knee ligament injury	125	5.8 (4.9 to 6.9)	30 (20 to 37)	390 (382 to 398)
<i>MCL injury</i>	75	3.5 (2.8 to 4.4)	33 (24 to 37)	154 (149 to 159)
<i>ACL injury</i>	9	0.4 (0.2 to 0.8)	275 (70 to 295)	92 (88 to 96)
<i>PCL injury</i>	6	0.3 (0.1 to 0.6)	20 (12 to 218)	23 (21 to 25)
<i>Posterolateral corner and LCL injury</i>	8	0.4 (0.2 to 0.7)	35 (7 to 132)	55 (52 to 58)
Lower leg	100	4.0 (3.2 to 4.9)	17 (14 to 23)	190 (184 to 196)
Ankle	147	6.9 (5.8 to 8.0)	15 (11 to 21)	320 (313 to 328)
Ankle sprain	113	5.3 (4.4 to 6.3)	15 (11 to 21)	228 (222 to 235)
<i>Lateral ligament sprain</i>	46	2.1 (1.6 to 2.8)	15 (9 to 19)	78 (74 to 82)
<i>Syndesmosis sprain</i>	34	1.6 (1.1 to 2.2)	33 (28 to 43)	108 (104 to 112)
Foot	40	1.9 (1.4 to 2.5)	37 (14 to 57)	84 (80 to 88)

See also figure 5, illustrating the same data set in less detail as a risk matrix, as well as the sections on rates, severity and burden of health problems, for an explanation of these concepts.

LCL, lateral collateral ligament; MCL, medial collateral ligament; PCL, posterior cruciate ligament.

When considering which severity criterion to use, investigators should consider the strengths and limitations of each approach related to the objectives of their study or surveillance programme.

Time loss from training and competition

The most widely used severity measure in sports medicine is the duration of time loss. It was recommended in previous consensus statements,^{3 5–8 44} and is relatively simple to capture, even when data collectors are non-expert—coaches, parents or athletes themselves.

When using this approach, we recommend that investigators record severity as the number of days that the athlete is unavailable for training and competition, from the date of onset until the athlete is fully available for training and competition.

The number of time-loss days should be counted from the day after the onset that the athlete is unable to participate (day 1), through the day before the athlete is fully available for training and competition. Therefore, cases where an athlete does not

complete a particular competition or training session, but returns on the same or following day, should be recorded as 0 days of time loss (see table 10 for examples). We note that in some cases, time loss does not follow immediately after the health problem occurred and may be delayed and/or intermittent (table 10).

When athletes recover from health problems during periods with no planned training or competition (eg, during an end-of-season break), investigators should record the end date as when the athlete normally would have been ready for full training and competition participation.

When aggregating data across athletes, report severity as the total number of time-loss days, together with median and quartiles. Means and SD should be interpreted with care, given that the distribution of time loss days is likely to be right-skewed.

When reporting data separately in severity categories, we recommend using the following time bins: 0, 1–7 days, 8–28 days, >28 days.

Consensus statement

Table 7 Recommended categories of organ system/region for illnesses

Organ system/Region	ICD-11	OSIICS	SMDCS	Notes
Cardiovascular	11	MC	CV	
Dermatological	14	MD	DE	
Dental	(13)	MT	DT	
Endocrinological	05	MY	EN	
Gastrointestinal	(13)	MG	GI	
Genitourinary	16	MU	GU	Includes renal, obstetrical, gynaecological.
Haematological	03	MH	BL	
Musculoskeletal	15	MR	MS	Includes rheumatological conditions.
Neurological	08	MN	NS	
Ophthalmological	09	MO	OP	
Otological	10	ME	OT	Ear only.
Psychiatric/psychological	06	MS	PS	
Respiratory	12	MP	RE	Includes nose and throat.
Thermoregulatory	(22)	MA	TR	
Multiple systems		MX	MO	
Unknown or not specified		MZ	UO	

ICD, International Classification of Disease; OSIICS, Orchard Sports Injury and Illness Classification System; SMDCS, Sport Medicine Diagnostic Coding System.

If one injury event results in multiple injuries, injury severity should be based on the injury leading to the longest time loss (eg, if a downhill skier crashes and suffers two injuries, a concussion which takes 10 days to resolve and a tibia fracture which takes 120 days, time loss for the event is 120 days).

Health problems contracted during multiday events

After athletes have left an event, it may be difficult to obtain accurate follow-up information on their condition and return to

Table 8 Recommended categories for aetiology of illnesses

Aetiology	ICD-11	OSIICS	SMDCS	Notes
Allergic	(22)	MxA	71	
Environmental—exercise-related	(23)	MxE	72	Heat illness, hypothermia, hyponatraemia, dehydration.
Environmental—non-exercise	(22/7)	MxS	73	Includes sleep/wake, sunburn.
Immunological/Inflammatory	(04)	MxY	74	
Infection	01	MxI	75	Viral, bacterial, parasitic.
Neoplasm	02	MxB	76	
Metabolic/nutritional	05	MxN	77	
Thrombotic/Haemorrhagic	(11/03)	MxV	78	
Degenerative or chronic condition	—	MxC	79	Chronic-acquired conditions.
Developmental anomaly	20	MxJ	80	Includes congenital conditions.
Drug-related/Poisoning	22	MxD	81	Includes pharma, illicit.
Multiple		MxX	82	
Unknown or not specified		MxZ	83	

ICD, International Classification of Disease; OSIICS, Orchard Sports Injury and Illness Classification System; SMDCS, Sport Medicine Diagnostic Coding System.

play. For cases that were not closed by a date of return to play at the time of the end of the event we recommend that:

1. If the researcher can liaise with team medical staff and record the actual date of return to play, this information should be captured. Collecting actual dates is recommended.
2. If this is not possible, then team medical staff should be asked to provide an estimate of when the athlete is expected to return to play. In such case, this information should be clearly labelled as an estimated severity.
3. If this is not possible, then event medical staff should record the date that the athlete leaves the tournament, that is, the last date on which the athlete was seen with the unclosed health problem. In such case, the information should clearly be labelled as a right-censored injury duration (a statistical term for situations in which only a portion of the time loss can be observed).

Limitations of using time loss to measure severity

Time loss generally reflects injury severity but has limitations. First, the demarcation between the end of time loss and the resumption of 'normal training and competition' is not necessarily a clear line in the sand. In some sports, athletes may be able to participate before an injury or illness has fully resolved, for example, by adapting technique, accepting a lower performance level or playing a different role in a team (eg, a ballet dancer working at the barre but not dancing on the floor or doing any jumps). Participation before an injury or illness is fully resolved would tend to 'underestimate' the absolute severity of the injury if one considered full healing as the gold standard. Conversely, athletes may choose not to resume their 'normal' training and competition for an extended period after an injury or illness has clinically resolved to allow them to regain full fitness (eg, a professional football player after ACL reconstruction). This would overestimate the severity of the condition.

Second, a time-loss-based severity measure underestimates the severity of those health problems that limit a player's performance but do not stop the person playing. Many gradual-onset injuries fit that bill (eg, patellar tendinopathy). Similarly, when athletes have a recurrent or chronic illness, such as asthma or inflammatory arthritis, they may have a relatively low time loss (from training, competition), but they may be markedly affected in training content and intensity.^{45–47}

Third, time loss is inappropriate to describe the most severe types of health problems such as those leading to retirement from sport, permanent disability or death because the time loss data from those injuries is right-censored.

Athlete-reported symptoms and consequences

There are tools to measure injury and illness symptoms that directly address the second limitation of time loss discussed earlier, underestimating the effect of ongoing pain and symptoms that are below the time-loss threshold. A tool such as the Oslo Sports Trauma Research Center Questionnaire on Health Problems (OSTRC-H) complements time-loss measures of severity, as it also captures symptoms and functional consequences of injury and illness. This purpose-built instrument was devised in 2013⁴⁵ and updated in 2020,¹³ and has played an increasing role in sports injury and illness surveillance, especially in sports and settings where overuse injuries and illnesses represent a substantial burden on health and performance.⁴⁸

The tool (which can be delivered via a mobile app) invites athletes to record reduced sports participation, training modifications, performance reductions and symptoms.⁴⁵ Based on the response to these questions, researchers can calculate a severity

Table 9 Recommended categories of illness symptom clusters for athlete self-report or non-medical data reporters

System/Region	Symptom cluster
Upper respiratory (nose, throat)	Runny nose, congestion, hay fever (allergy), sinus pain, sinus pressure, sore throat, cough, blocked/plugged nose, sneezing, scratchy throat, hoarseness, head congestion, swollen neck glands, postnasal drip (mucus running down the back of the nose to the throat).
Lower respiratory	Chest congestion, wheezing (whistling sound), chesty-cough, chest pain when breathing/coughing, short of breath, laboured breathing,
Gastrointestinal	Heartburn, nausea, vomiting, loss of appetite, abdominal pain, constipation, weight loss or gain (>5 kg in last 3 months), a change in bowel habits, diarrhoea, blood in the stools.
Cardiovascular	Shortness of breath, racing heart beats, irregular or abnormal heart beats, chest pain, chest pain or discomfort with exercise, dizziness, fainting spells, blackouts, collapse.
Urogenital/Gynaecological	Burning urination, blood in urine, loin pain, difficulty in passing urine, poor urine stream, frequent urination, genital sores, loss of normal menstruation, irregular or infrequent menstruation, menstrual cramp/pain excessively long periods, excessive bleeding during periods, vaginal discharge, penile discharge, swollen groin glands.
Neurological	Headache, fits or convulsions, muscle weakness, nerve tingling, nerve pain, loss of sensation, chronic fatigue.
Psychological	Anxiety, nervousness, excessive restlessness, feeling depressed (down), excessive sadness, not sleeping well, mood swings, feeling excessively stressed.
Dermatological	Skin rash, dark/light/coloured areas on the skin that have changed size or shape, itchy skin lesions.
Musculoskeletal, rheumatological and connective tissue (unrelated to injury)	Joint pain, joint stiffness, joint swelling, muscle twitching, muscle cramps, muscle pain, joint redness, warmth in a joint.
Dental	Tooth ache, painful gums, bleeding gums, oversensitive teeth, persistent bad breath, cracked or broken teeth, jaw pain, mouth sores.
Otological	Ear pain, ear discomfort, loss of hearing (new onset), deafness, discharge from ear canal, bleeding from ear canal, ringing in the ears.
Ophthalmological	Pain in eye, itching or burning eye, scratchy eye, eye discharge, change in vision including double vision, blood in eye, excessive tearing, abnormal eye movements, swelling of eye, blind spot in the eye, drooping eye, halo around lights, lightning flashes, swelling of eyelid.
Non-specific illness	Feeling feverish, chills, pain, whole body aches, feeling tired.
Energy, load management and nutrition (non-body system)	Unexplained underperformance, reduced ability to train and compete, fatigue.

score ranging from 0 to 100 at specific time points. These can be aggregated (summed as the area under the curve) to monitor injury and illness over time (figure 4). This is called the cumulative severity score. A limitation of this method is that severity score is an arbitrary number and it has not been thoroughly validated as a proxy for injury severity.

Recording the severity of health problems based on clinical assessment

Investigators may also report the severity of health problems based on clinical outcomes such as the need for hospitalisation or surgery,^{10 42} retirement from sport, permanent disability, or death.^{10 49}

Degree and urgency of medical attention

The severity of an injury or illness can also be recorded based on the degree and urgency of medical attention received by the athlete. This approach is best suited to recording acute

conditions, and it is often used in mass-participation events and community sport settings.^{42 50 51} An example using this approach is provided by Schwellnus *et al*¹⁰ in their statement on mass community-based endurance sports event.

Permanent disability and death

All conditions leading to permanent disability or death that occur during the period of data collection should be reported separately. There are some specific definitions accepted in the field:

- *Catastrophic injury* refers to a confirmed spinal cord or traumatic brain injury resulting in permanent functional disability (using American Spinal Injury Association (ASIA scale)⁵² and assessed at 12 months). This does not include injuries resulting in transient neurological deficits such as burners/stingers, paraesthesias, transient quadriplegia or cases of concussion where there is full recovery. The term catastrophic events has also been extended to include non-injury events that are life-threatening, such as sport-related sudden cardiac arrest and exertional heatstroke⁵³; more

Table 10 Practical examples of how to calculate time loss

Case	Time loss (days)
A college volleyball player is substituted from a match due to injury, but returns to compete in another match later the same day	0
A cyclist interrupts a training session due to mild diarrhoea, and resumes normal training the following day	0
A hockey player strains her hamstring during a training session on a Monday and returns to normal training on Monday of the following week.	6
A recreational-level cricket player injures his shoulder during a match on a Saturday. 2 His shoulder is stiff and painful for 2 days following the match (Sunday and Monday). The team only trains once per week, every Thursday, but the player feels he would have been able to train normally had training been on Tuesday instead	
'Delayed' time loss: Sunday injury, thigh contusion, able to train on Monday and Tuesday but unable to train on Wednesday and returns on Sunday (time loss starts on Wednesday even though the injury was on Sunday).	3
'Intermittent' time loss: boy with Osgood-Schlatter disease that gets reported at the start of a training camp on Monday. The player may train fully on Monday, Tuesday and Thursday, but miss training on Wednesday and Friday (time loss counted as Wednesday and Friday only)	2

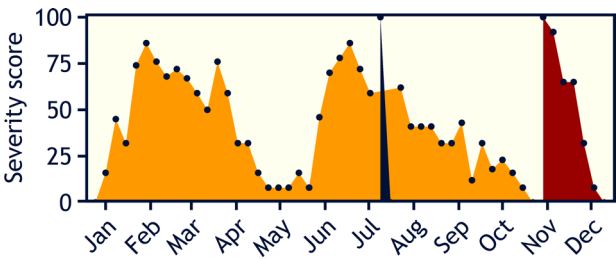


Figure 4 Example of severity scores being used to track the severity of three 'typical' health problems. Each black dot represents the weekly severity score. The area in orange represents a gradual-onset injury (cumulative severity score (the sum of weekly scores, the area under the curve): 1820), the black area represents a short-duration illness (100) and the dark red area represents an acute medial collateral ligament injury (362).⁴⁵

Consensus statement

detailed recommendations on this issue are provided in the consensus statement on mass community-based endurance sports events.¹⁰

- **Fatality:** any athlete fatality related to training or competition. When fatalities occur months or years after the event, researchers should justify the relationship to training/competition.^{49 54}

As such cases often receive media attention, we remind investigators to consider privacy issues. Special considerations apply to approaching, consenting and collecting data from families who have sustained a major loss.

Other severity measures

Depending on the sport setting and the purpose of data collection, investigators may also quantify severity in other ways.⁴¹ Function, performance and patient-reported outcome measures may be used to capture severity. Specific examples include:

- Functional measures, for example, International Classification of Functioning, Disability and Health.⁵⁵
- Sports-related performance measures, for example, balance, strength and endurance. We include athletes reporting retirement from sport in this category.
- Patient-reported outcome measures, for example, ACL Quality of Life questionnaire,⁵⁶ Knee injury and Osteoarthritis Outcome Score⁵⁷ and Sport Concussion Assessment Tool.⁵⁸

CAPTURING AND REPORTING ATHLETE EXPOSURE

Assessing exposure is fundamental to quantifying injury and illness risk in sport.^{42 59} There are many ways to quantify athletic exposure and no single measure will suit all surveillance settings and research questions. The choice of exposure measures is heavily influenced by sport-specific and contextual factors, as well as which types of health problems are of interest. Therefore, it is often necessary to record exposure in several ways.

Tracking exposure for injury analyses

For injuries, exposure is generally quantified as the time during which athletes are at risk of injury (eg, minutes played), distance covered or a count of the number of specified events (eg, tackles, throws or jumps). In some sports, exposure is commonly expressed as the number of athletic participations (eg, games, races, training sessions), often referred to as 'athletic exposures'. Table 2 in online supplementary appendix 1 provides a range of examples of exposure measures used.

In team sports, we recommend recording exposure for each individual within a team rather than merely estimating the number of matches the team plays and match duration (team exposure), because the former permits the researcher to examine individual risk factors. Results of all the individuals are then summed to provide exposure at the sport or team level.

As injury risk is often markedly different between training and competition, these exposures should be recorded and reported separately. To do this consistently, it is necessary to define competition and training, and to consider situations where applying the definition may be challenging.

We define competition as *organised scheduled play between opposing athletes or teams of athletes, or athlete(s) competing (i) against time and/or (ii) to obtain a score (judged or measured).*

We define training as *physical activities performed by the athlete that are aimed at maintaining or improving their skills, physical condition and/or performance in their sport.*

In many sports, it is common to simulate competition as a part of training. Examples include preseason 'friendly scrimmages'

between two teams or dividing a single squad into teams that compete against each other. In general, this should be counted as training exposure. Additionally, activities such as warm up and cool down should be counted separately and reported as training injuries, even if occurring around competition.

It is likely that in some sports, these definitions will not be fully applicable. In such cases, we encourage sport-specific consensus groups to define what constitutes competition and training in that sport.

Tracking exposure for illness analyses

Because athletes remain at risk of developing illness even when they are not participating in sport, it is inappropriate to use exposure measures such as playing hours or movement counts to quantify illness risks (except for the rare cases of transmissible infections that are specific to participation in a sport, eg, scrum-pox). Instead, it is often most appropriate to use exposure measures based on the time athletes are under surveillance (eg, days or years), rather than time engaged in competition and training.

Recording exposure during multiday competitions

Multiday competitions, such as championships and tournaments, represent an exposure measurement challenge, particularly for injury analyses. Ideally, investigators should obtain accurate records of every athlete's individual participation (eg, training and competition minutes) throughout the tournament. However, this is not always feasible. Acceptable exposure estimates can also be made by obtaining summary data from every team for each day of the tournament (eg, squad numbers). As a minimum standard, exposure can be estimated for each event by multiplying the number of registered athletes by the duration of the tournament (the number of days of competition). In multisport tournaments, this should be calculated for each sport. However, this approach assumes that all athletes have the same exposure and participate every day, which is rarely the case.

Training subcategories

Different types of training should, if possible, be recorded and reported separately. Training types can be generally categorised as follows:

1. Sport-specific training: sessions involving the techniques and/or tactics of the sport, usually supervised by of a coach.
2. Strength and conditioning: sessions solely composed of resistance training and/or conditioning training. In many cases, training sessions are mixed (sports-specific, but with addition of some strength and conditioning, eg, plyometrics, endurance). As a pragmatic consideration, any session containing sports-specific training should be categorised as such, even if the session includes some strength and conditioning, purely to streamline exposure tracking.
3. Other training sessions: sessions that include activities other than sport-specific training or strength and conditioning. These include recovery sessions (eg, low-intensity running and stretching), rehabilitation and postrehabilitation transition sessions (ie, postreturn to sport but prior to resuming normal training).

Sport-specific injury surveillance systems may need to depart from this guidance if there is a need to address a specific training concern, however, at a minimum, all training exposure that contain sports-specific training should be tracked.

Sport-specific injury surveillance systems are encouraged to develop specialised procedures for tracking the diversity of training exposures in their particular sport. Training programmes vary considerably among sports and many coaches intentionally

design training programmes that integrate multidimensional training (eg, plyometric stretching, sports-specific training, light running) into a single session. In general, investigators should prioritise capturing specific data on the training activities considered to present the greatest health risk.

Wearable physical activity tracking devices enable investigators to capture large volumes of competition and training data at the elite level and from community sports participants across large sample groups. We encourage the use of these devices for tracking exposure. However, we caution that any device needs to be fit for purpose, and researchers should obtain evidence on their validity and reliability *before* data collected through these devices are used for injury surveillance.

EXPRESSING RISK

Rates and proportions

Rates and proportions of injury and illness in studies of sports are usually reported as a count of 'cases' of the outcome of interest (the 'numerator'), divided by a population at risk of developing the outcome (the 'denominator').⁶⁰ Because research questions such as 'How many players have suffered a knee injury?', 'What is the risk of getting injured in this sport?' and 'How does sport A compare with sport B for concussion risk?' are very different, there are various ways of reporting risks relating to sports injury and illness. We explain some fundamental terms here.

Prevalence—How many? Prevalence is a proportion and refers to the number of *existing cases* divided by the total population at risk at a given point in time (point prevalence, eg, the proportion (percentage) of *players* in a volleyball team who—today—are suffering from patellar tendinopathy). It is a snapshot at one point in time, but can be repeated to determine changes in prevalence over time (eg, weekly). With serial measurements, it is possible to report, for example, the average prevalence over the course of the season and also to compare different stages of the season.

Period prevalence extends the concept of a single point in time to a window of time (eg, one season, a year). It refers to the proportion of *athletes* that has reported the condition of interest (eg, patellar tendinopathy) at any time during that given window. Notably, this includes people who already had the condition at the start of the study period as well as those who acquired it during that period.

Incidence—How often (do new cases occur)? Incidence is a rate and, as with any rate, time comes into play. Incidence refers to the number of *new injuries/illnesses* in the population that develop during a defined period of time. The term 'incidence rate' is synonymous, but we argue that it is a tautology—'incidence' is a rate.

Note that prevalence is calculated based on the *number of athletes* with a health problem, while incidence refers to the *number of new health problems*.

Recommendations: expressing risk in SIIS

Incidence-based measures usually represent more appropriate outcomes for sudden-onset conditions (eg, ankle sprains, ACL injuries) and prevalence-based measures for gradual-onset conditions (eg, asthma, patellar tendinopathy).⁴⁶ Overuse injuries and pain problems such as low back pain and patellar tendinopathy are often chronic, with periods of remission and exacerbation. For example, in a professional volleyball team, there could be only one new case of patellar tendinopathy (so incidence will be low), yet 40% of the players (ie, nearly all pre-existing) could be affected by patellar tendinopathy during the season (period prevalence). Therefore, for such conditions, prevalence (the

proportion of *athletes* affected) is a more appropriate measure than incidence (the number of new *cases* during the season).

Because sports and the activities that comprise them are so diverse, there is no single approach to expressing risk appropriately for all sports injury surveillance projects.⁶¹ In general, incidence-based measures that provide a standard time-window for the population at risk (injuries per hour) are preferable to measures for which the time at risk varies across individuals (injuries per athletic exposure, ie, per training session or match), because time-based measures better facilitate comparison across sports.

To provide numbers that are easy to interpret, avoiding small decimals, these data are typically reported as 'per 1000 player hours' (eg, concussion rate in men's rugby study was reported as 4.7 per 1000 player hours, rather than 0.0047 per player hour).⁶² Such numbers allow risks to be compared (eg, How does concussion risk vary across contact sport codes?). We expect that subsequent sport-specific statements will recommend suitable, standard incidence-based measures for each sport. Table 2 in online supplementary appendix 1 provides a range of examples of risk measures.

If one injury event results in multiple injuries, these should only be counted as one when calculating overall injury incidence (eg, if a downhill skier crashes and suffers two injuries, a concussion and a tibia fracture, these are counted as one injury when calculating incidence).

Because of the difficulties in accurately measuring exposure to pathogens (which may be greater when not training or competing), illness risk should be estimated based on the entire period of exposure (eg, the duration of a competition, a 'season of play', a year), not athletic exposure only. We recommend reporting illness risk as either the incidence, the number of new illness *cases* divided by a period of time (eg, illnesses per 365 athlete-days),⁶³ or as the period prevalence of illness, the proportion of *athletes* that were ill during a defined period.^{64 65}

Where time-based measurements of exposure are unavailable, but participant numbers are available, crude rates of injury per number of participants per period can be derived. In such cases, we suggest that the incidence that may be most useful to permit *population-level* comparisons among sports or studies is 'injuries per 365 athlete-days'.

Similarly, the proportion of participants with new or recurring injury or illness (ie, excluding pre-existing cases and exacerbations) during the event has been used to provide an impression of the risk associated with participation in each sport in both the summer and winter Olympic Games.^{64 65} However, this approach—period prevalence—can suggest widely different relative risks of activities that differ substantially in the amount of exposure participants experience.⁶⁴ For example, exposure differs substantially between a football player and a sprinter. Period prevalence describes the absolute risk of participation in the Olympic Games, but not the relative risk (the risk of injury during 1 hour of football play vs 1 hour of marathon running).

Injury rates reported on a per-event (eg, per rugby tackle) basis provide information about how likely a particular aspect of play ('event') is to result in injury. Understanding events that both do⁶⁶ and do not result in injury^{67 68} helps researchers identify injury prevention opportunities. In the absence of information about how frequently the event occurs within a sport and the average duration of the sport in which participants are exposed, rates per event also provide an incomplete view of the overall risks a sport poses. Using time-based and event-based denominators (eg, tackles in football codes) in parallel can help provide insights into both, which event (eg, tackle type) is most frequently associated with injuries and which event carries the

highest risk when it occurs. To date, there have been relatively few injury surveillance studies in which such statistics have been provided together.²⁹ For televised sports and those using new technology such as activity trackers, measurement of the duration of playing time and intensity for each individual is feasible, and coding of the number, characteristics and duration of activities each participant engages in (eg, tackles) is routine for some professional sports (eg, football). We include a real-life illustrative case of surveillance methods being used to investigate injury risk in rugby in online supplementary appendix 1.

Communicating risk to stakeholders

From clinical and practical perspectives, it is important that the end-users (the athletes, coaches and medical staff members) can make sense of the injury reports and increase the chances of having them participate in risk management plans. This can be done by expressing the injury incidence based on the concerned sport's specifications. For instance, if an injury incidence for a specific muscle group (eg, hamstrings) is expressed as 0.9 injuries per 1000 hours of exposure, the incidence per player per season (0.28 injuries per player per season) could be multiplied by the average number of athletes per squad for the concerned sport (eg, 25 in football). This gives seven hamstring injuries per squad per season, a quantity which is more easily interpreted by end-users.

Another relevant measure, which is easy to communicate to managers, coaching staff and athletes, and which is associated with team performance in football,⁶⁹ is player availability. Player match availability is calculated as the sum of player match opportunities (ie, the number of matches multiplied by the full size of the squad) minus the sum of player match absences due to injury or illness, and can be expressed as the average percentage over the period of interest (eg, one season). Training availability can be calculated in the same way.

We encourage sport-specific consensus statements to recommend relevant measures to communicate risk to relevant stakeholders.

BURDEN OF HEALTH PROBLEMS

Burden is a collective measure of the overall impact of a health problem in a specified population. In public health, burden is often expressed by financial cost, mortality or morbidity. One common approach is specific measures such as quality-adjusted life years or disability-adjusted life years.⁷⁰ Burden allows different health problems to be compared—Does low back pain or diabetes cause more burden to society?

The burden of injuries and illnesses can also be expressed using measures that combine their frequency and consequences.^{71–72} For example, in football and rugby union, injury burden has been reported as the number of days of time loss per 1000 hours of player exposure.^{73–79} This contrasts with incidence (discussed earlier) where the numerator is the *number of injuries*, rather than the consequence of those injuries—days of time loss.

As measures of incidence and consequences vary depending on the purpose and setting of data collection, there is no single method of calculating burden in sport. To facilitate comparison among sports, investigators should consider reporting the number of days of time loss per 365 athlete-days for each outcome of interest, in addition to measures based on sport-specific exposures. We expect that subsequent sport-specific statements will provide recommendations on suitable, standard burden measures for each sport.

Burden can also be visualised using a risk matrix, in which the incidence of each health problem of interest is plotted against its

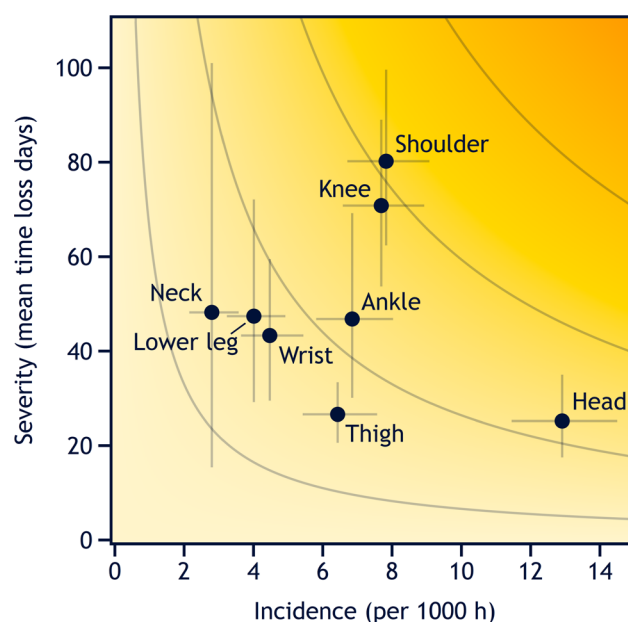


Figure 5 Risk matrix based on the duration of time loss illustrating the burden of match injuries among professional rugby teams in New Zealand between 2005 and 2018 (unpublished data). The darker the yellow, the greater the burden. The curved grey lines represent point with equal burden. The vertical and horizontal error bars represent 95% CIs. See also table 6, illustrating the same dataset in more detail.

consequences (such as mean time loss, as illustrated in figure 5). This is an effective way to communicate the overall burden (and its determinants) for a range of health problems. However, there are certain limitations to interpreting risk matrices, depending on how figures are designed and how data are structured (see Fuller for a detailed review).⁸⁰

Burden measures that use time loss as a measure of severity fail to incorporate the most severe health problems (ie, fatalities and non-fatal catastrophic injuries and illnesses) and other cases where the athlete fails to return to sport (eg, due to retirement). As previously discussed, time-loss-based severity measures also under-represent overuse injuries and chronic illnesses.^{46–47} In this case, mean OSTRC-H severity scores can be used instead of time loss, as illustrated in figure 6.¹³

STUDY POPULATION CHARACTERISTICS

Depending on the purpose of the study, demographic and health data may be included in injury and illness surveillance protocols. The demographic information captured should, as a minimum, include age, sex and level of competition and disability/impairment type in Paralympic sport. These can be supplemented with data on other relevant characteristics that could help investigators evaluate risk factors.

It is important to describe the performance and training level of the study population, both because they are often closely related to health outcomes and to allow appropriate studies to be compared.⁴² It is beyond the scope of this consensus group to provide a universal classification of competitive level. For example, the criteria used to define 'elite' vary considerably among sports. We encourage sport-specific methodological consensus groups to define what constitutes 'elite', 'sub-elite' and 'recreational' athletes in their sport.

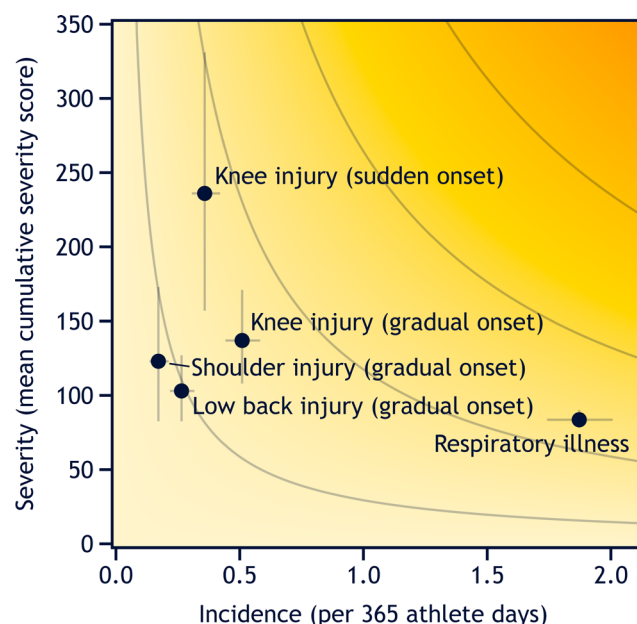


Figure 6 Risk matrix based on Oslo Sports Trauma Research Center Questionnaire on Health Problems severity scores illustrating the burden of injuries and illnesses affecting elite Norwegian endurance athletes (unpublished data). Error bars represent 95% CIs.

Classification of sport categories

There are many ways of classifying and grouping sports. Any sports classification system used in surveillance should be clearly described in the methods section of reports. The description should permit other researchers to understand and replicate the process by which sports were grouped. The research problem being addressed should shape the classification system used, rather than vice versa.

DATA COLLECTION METHODS

The methods underpinning the data collection have great impact on the outcome of sport injury and illness surveillance studies.^{42 81 82} A systematic review of ongoing injury surveillance systems in sport found that data quality aspects were published for only 7 of the 15 systems and validation studies for only 4.⁸³ The review concluded that data quality could be improved through the establishment of data collection standards.

Given the wide range of settings in which surveillance is undertaken, the data collection methods should be flexible enough to adapt to the specific context (eg, sport culture, level of sport, availability of resources) and to the specific research question and objectives of the study.⁴² These factors in combination will determine:

- ▶ *who* should provide the information (eg, athlete, physician, physiotherapist, coach, non-clinical volunteer);
- ▶ what *data sources* should be used (eg, athlete self-report, medical records, examinations, video recording);
- ▶ the *frequency* of data collection and reporting (eg, daily, weekly, monthly);
- ▶ the *timing* of and window for data collection (eg, day of injury/illness or of competition/training or following day, within a week);
- ▶ the *duration* of surveillance (eg, tournament, season, whole year, playing career).

Taking all of these variables into account, it is evident that ‘one size does not fit all’.^{84 85}

Box 1 Implementation recommendations for injury/illness surveillance; the implementation of an injury and illness surveillance project should include the following aspects:

- ▶ Methods based on this consensus statement on definitions and data collection procedures.
- ▶ Mandatory standards for compliance with defined timescales for completion for report forms.
- ▶ Guidance document (a quality protocol) shared with all clubs/national team’s medical staff (preseason/tournament).
- ▶ Regular contact between study lead and responsible person at each club/national team (face-to-face meeting preseason/prior the tournament, conference call mid-season/tournament).
- ▶ All injuries cross-checked with club/teams medical records and followed up with medical staff for missing, incomplete, inconsistent or duplicate entries (regularly during season/tournament).
- ▶ Data cleaning and final review of the dataset with responsible person at each club/team prior to definitive analysis (end of season/tournament).
- ▶ Injury reports where individual club/team data are reported, analysed and compared with the average of all participating clubs/teams (mid-season and end-of-season/tournament).
- ▶ Medical meeting (end of season/tournament), where whole surveillance results and translational value are presented to club/team medical practitioners for discussion.

In 2001, WHO^{81 86} published guidelines for injury surveillance that remain relevant. In particular, some general aspects about quality of the data collection systems (ie, objectivity, reliability, validity, practicability, risk of bias, cost-effectiveness/time-effectiveness, acceptability), quality of implementation (eg, guidance document, communication, compliance and data check) and some methodological issues (eg, handling of missing values, completeness of reports, coverage, response rate) are important.^{9 87 88} In addition, the choice of injury definition, exposure measure and methods used to express rate influence the results substantially, as discussed in the relevant sections of this document.

The *reliability* of the system can be improved by tailored education, ongoing support for the people who report the data and a detailed process manual,⁸⁶ and should be evaluated at least by analysis of inter-rater reliability of people reporting the data.⁸⁸

Validity and completeness of data reporting can be analysed comparing with another “gold standard” data source.^{38 89–93} A recent study showed that research-involved staff recording the data in a surveillance programme reported a greater number of mild injuries than did non-researchers.⁹⁴

An example of specific measures to improve reliability of a surveillance project is illustrated in [box 1](#), based on the procedure of the Professional Rugby Injury Surveillance Project.⁹⁵

From pen and paper to electronic solutions

Health problems and exposure can be captured using different methods ranging from paper copy data collection forms to a comprehensive web-based surveillance system, for example, internet platforms, apps or text messaging.^{51 90 91 96–100} The traditional pen and paper approach is often easy to implement,⁵⁰ as

Consensus statement

it reduces the need for specific technical knowledge, equipment and related costs.^{51 101} Data can be verified and cleaned as they are manually entered.¹⁰¹

Electronic data capture reduces time for duplication of data entry,⁵⁰ and associated entry errors.¹⁰¹ In terms of costs, there is potential long-term cost-effectiveness through the elimination of expenses linked to the printing, shipping, management and storage of physical documents.¹⁰¹

Web-based solutions allow instant and remote on-demand queries of real-time data (including end-users such as team medical staff), as well as integration with other data feeds (eg, performance, load, sleep). Web-based solutions should preferably be prototyped prior to being implemented in a larger injury surveillance setting. Full integration of surveillance reporting systems within clinical electronic medical record keeping systems has been used successfully in a number of professional elite leagues.¹⁰² While electronic solutions can lead to high response rates among athletes,^{90 91 98} there are also reports of poor athlete engagement,⁹⁷ and thus demonstrates the importance of understanding uptake barriers. It is important to use surveillance tools that minimise intrusion into the daily activities of the data reporters (athletes, medical teams, coaches), for example, by limiting the number of questions to responders so that only essential data are captured. Another recommendation is to provide a clear incentive to athletes and teams to participate in injury surveillance, for example, by allowing continuous feedback within the data collection system (eg, performance data, load monitoring data) or sending regular reports back to the teams, athletes and other relevant stakeholders.¹⁰³

Data collection methods must be adapted to the specific research question, the sport context and the skill set of the research team, and should follow strict quality standards. The quality of the surveillance system includes the quality of the forms (baseline, health problems and exposure) as well as the quality of the data collection procedure, implementation, data cleansing and analysis methods.⁵¹ The quality and usability of the forms and the data collection procedures should be examined before implementation. Reliability and validity should be analysed, and all translations should follow the standards of intercultural adaptation.^{104 105} The adherence to the data collection protocol as well as the completeness and consistency of responses should be monitored on a regular basis during implementation. Collaboration between research groups to share resources and joint data analytics can help advance the management of sport injuries/illnesses.¹⁰⁶ Having data collection forms and related material available in free-to-access formats make it easier for sports bodies to participate in surveillance activities,⁵¹ and this consensus statement includes some sample forms as mentioned in online supplementary appendix 2.

Research ethics and data security

Research ethics govern the conduct of medical research and aim to protect the dignity, rights and welfare of human participants. They detail principles such as informed consent, data confidentiality, the use of research ethics committees and risks, burdens and benefits. Importantly, informed consent is the process in which permission is granted in full knowledge of the possible consequences (risks and benefits), for example, for their data to be used for research purposes. In some contexts, injury and illness surveillance may be regarded as an integral part of data audit and quality control processes, and—as long as individual patient data are fully deidentified—may

not require informed consent. It is the duty of all researchers (and all other users of the data) to consider—and adhere to where appropriate—internationally recognised guidelines for research ethics (such as the Declaration of Helsinki¹⁰⁷ and the Declaration of Taipei).¹⁰⁸

Data protection governs how data are collected, shared, used and conserved, and aims to ensure that personal data are safe from unforeseen, unintended or malevolent use. Particular attention must be directed to the security of data stored on cloud-based systems and other electronic repositories. Researchers must adhere to the data protection regulations applicable to their context (such as General Data Protection Regulation in Europe).¹⁰⁹

REPORTING GUIDELINES: STROBE SPORTS INJURY AND ILLNESS SURVEILLANCE

The statement on STROBE was published in 2007.¹¹⁰ Since then, it has been adapted ('extensions') to ensure the statement is relevant to other areas of interest such as infectious diseases,¹¹¹ and most recently (2018) for pharmacoepidemiology.¹¹² These extensions of STROBE have stressed, like the original, that they only guide on how to *report* findings from observational studies rather than guiding *study design*. However, the two are related and researchers are strongly encouraged to consider the elements of the checklists when planning studies—this may eventually improve study quality and ensure researchers are able to report what is needed at the end of the study. STROBE has checklists for the three most common study types: cohort studies, case-control studies and cross-sectional studies. Here, we summarise our consensus recommendations on the collection and reporting of SIIS data as an extension to the initial STROBE checklist. These apply regardless of study design. Note that many other study designs common in sports and exercise medicine research—such as randomised controlled trials—should be reported against other reporting standards (like Consolidated Standards of Reporting Trials, which will be refreshed in 2020).¹¹³ As most sports medicine studies rely on surveillance methods to collect injury and illness outcome data, the recommendations in this consensus statement apply widely.

To guide researchers in the field of sport and exercise medicine, we have adapted ('extended') the STROBE checklist so that it reflects recommendations from this current IOC consensus statement on studies of injury and illness surveillance in sport. This extension refers to 21 of the original items. It includes only items specific to the reporting of injuries and illnesses in sport, as amendments to reflect broader epidemiology methodology developments should be more appropriately documented by the EQUATOR network which oversees STROBE.

It is intended that this new checklist—STROBE-SIIS—will help researchers design an injury/illness surveillance study and plan the study protocol, as well as better report their observations (online supplementary appendix 3). By consistently using STROBE-SIIS, the authors ensure that other researchers will be able to more easily replicate, compare and synthesise sport and exercise medicine research studies.

We also strongly recommend that researchers publish their study protocols ahead of study completion, ideally with an open-access formal register, and also report on any changes made to the initial protocol during study conduct, together with their rationale for the change, once the study has been completed. Details of where protocols and their amendments are publicly available should be stated in papers submitted for publication.

Feedback on this checklist is welcome and we will both monitor and evaluate the impact of its use overtime. We welcome researchers with relevant expertise to translate this checklist to other languages for the benefit of the international sports medicine community.

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Appendix 1: Case study: Tackle injuries to ball carriers in rugby

The data set

A study was conducted in which video records of every tackle that occurred in 434 professional rugby matches was coded on a range of dimensions, including the location on the body at which the tackler(s) contacted the ball carrier ('tackle height').¹ The information in the table has been restricted to that from 43 366 tackles in which a single tackler tackled a ball carrier (i.e. the 100 tackle events per match that met this criteria). For the purposes of the example below, an injury is defined as 'any injury sustained by a ball carrier during a rugby tackle that required them to be removed from the field of play for the remainder of the match'.

Different denominators: different perspectives on risk

Rates of injury have been presented in Table 1 as 'per 10 000 tackles' and 'per 10 000 player-hours'. If data were reported using only the time-based denominator, as has been the case in most studies of sports injury epidemiology, the conclusion drawn would be that 'high' and 'middle' tackles are those that carry the greatest risk to ball carriers. When the relative frequency of the tackles is considered, and the rates are presented on a 'per 10 000 tackles' basis, head/neck tackles place ball carriers at the greatest risk of injury *when they occur*.

Table 1 Injury rates to ball carriers in rugby tackles, expressed via event-based and time-based denominators.

Injuries requiring the player to be removed from the match				
Tackle height	Tackles per match	Per 10 000 tackles	Per 10 000 player-hours	Percent of injuries per 10 000 player hours
Head/neck	4 ± 2	43 (23 to 79)	4 (2 to 8)	13 (7 to 23)
High	37 ± 10	12 (8 to 17)	11 (8 to 16)	36 (26 to 47)
Middle	44 ± 9	9 (6 to 13)	10 (7 to 15)	32 (23 to 43)
Low	15 ± 5	16 (9 to 26)	6 (3 to 10)	19 (12 to 29)

The different perspectives provided by 'per-event' and 'per-time' denominators can be helpful in identifying injury prevention priorities. If the overall risk of injuries was considered 'unacceptably high' by those responsible for managing the risks in the sport, then reducing the numbers of the most

common tackles in the game would have the greatest effect; together ‘high’ and ‘middle’ tackles account for over two-thirds of all tackle injuries requiring ball carriers to be removed from the pitch. Reducing the numbers of such tackles, or the characteristics of them, would probably require major changes to the sport of rugby. If, however, the overall degree of risk was considered ‘acceptable’, then focussing on decreasing the number of ‘head and neck’ tackles would have a modest effect on overall injury rates, but reduce the occurrence of a particularly risky element of the sport (note: head/neck tackles are not permitted within the laws of rugby, but sometimes occur).

The type of exposure measures that can form the basis of risk statistics is presented in Table 2, along with a range of the risk measures that have been reported in studies of team sports injury epidemiology. The examples are taken from the same study discussed above.

Table 2 A range of exposure and risk statistics derived from injury surveillance data - examples from a study of rugby tackle injuries.¹

Statistic	Value	Calculation	Explanation	Comment
Injury statistics				
Number of injuries (carrier injury replacements in 434 matches)	53	Nil	Count of the number of tackler injuries requiring the injured player to be replaced observed in 434 matches.	The ‘numerator’ used for calculating the rate of tackler replacement injuries per unit of time or per tackle. Absolute numbers and costs of injuries <i>are</i> of interest to risk managers, especially when provided in parallel with rates
Number of injured players (some were injured more than once)	48	Nil		The numerator for calculating ‘injury risk’
Exposure measures				
Player hours in 434 matches	17 360	30*579	Thirty players (15 from each team) multiplied by 579 (hours of play in 434 matches of 80 minutes duration)	This number provides a ‘time-window’ denominator. Usually it is assumed that time lost for yellow and red cards, or time gained for ‘extra time’ is negligible and is ignored.
Number of single tackler tackle events in 434 matches	43 366	Nil	All tackles in 434 matches were coded, regardless of whether they resulted in injury	This number forms an ‘event-based’ denominator.

Statistic	Value	Calculation	Explanation	Comment
Number of players who appeared in the 434 matches	1403	Nil		This is a count of the size of the cohort across the entire study period; it is used as the denominator for calculating 'injury risk'.
Number of full player matches	13 020	30*434	Thirty players (15 from each team) multiplied by 434 matches	This number provides a 'per-match' denominator.
Number of athlete-exposures (athlete-participations)	17 685	Nil	Count of the number of players who took the field over 434 matches (players can be substituted for tactical purposes or replaced due to injury)	The similarity to the number of player hours is coincidental; there are 40 hours of player-time per match, and the average number of athlete exposures per match over this series of matches was 40.8.
Risk measures				
Period prevalence (percentage of cohort injured)	3%	$(48/1403)*100$	Percentage of people who appeared in matches who were replaced	Often reported as 'risk per season' or 'risk per year'. Can't be easily used to compare between activities if the duration of surveillance varies from activity to activity. The longer the surveillance period, the higher the risk will appear to be for closed cohorts
Injuries per 1 000 player-hours	3.1	$(53/17\ 360)*1\ 000$	The number of injuries is divided by the number of hours of player exposure, and multiplied by a scaling factor (e.g. 1 000, 10 000) to provide a rate that is convenient to work with (e.g. numbers in the range of 1	The most commonly reported metric of injury rates in studies of rugby injury epidemiology has been rate of injuries per 1 000 player-hours. This convention is endorsed in the consensus document by Fuller et al. ²

Statistic	Value	Calculation	Explanation	Comment
			to 1 000 rather than numbers less than zero or greater than 1 000	It is relatively simple to estimate based on the number of matches played. Comparisons of incidence rates between activities or within activities over time based on this denominator require the assumption that the number and characteristics of energy transfers to which participants are exposed remains relatively constant per unit of exposure time.
Injuries per 1 000 matches	122	$(53/434)*1\ 000$	Rate of tackler replacements per rugby union match multiplied by 1 000. The rate per match is multiplied by a factor that provides a convenient interpretation; 0.12 carrier replacement injuries per match; 12.2 per 100 matches, 122 per 1 000 matches etc.	Ignores number of players and match duration, and provides an estimate of the number of injuries an observer would expect to see if they watched 1 000 matches. Not useful for comparing incidence rates between activities of differing durations or numbers of participants.
Injuries per 1 000 hours of play (ignoring number of players)	92	$(53/579)*1\ 000$	The rate per hour is multiplied by a factor that provides a convenient interpretation; 0.9 carrier replacement injuries per hour; 9.2 per 100 hours, 92 per 1 000 hours etc.	Ignores number of players, and provides an estimate of the number of injuries an observer would expect to see if they watched 1 000 hours of play. Not useful for comparing between activities with differing numbers of participants (because the sizes of the populations at risk differ)
Injuries per 1 000 athlete-exposures	3.0	$(53/17685)*1\ 000$	Carrier injury replacements per 1 000 athlete exposures	Injuries per 1 000 athlete exposures are commonly reported in injury surveillance in the United States. Problematic for comparing between activities that

Statistic	Value	Calculation	Explanation	Comment
(athlete-participations)				have different numbers of typical athlete exposures per match, or when the average exposure time per player changes over time.
Injuries per 1 000 full player matches	4.1	(53/13020)*1 000		Not commonly used. It ignores the duration of the match, and as such has similar drawbacks to reporting injuries per athlete exposure, because the time-window of exposure varies between activities of different durations.
Injuries per 1 000 'ball in play' player-hours	6.8	(53/7740)*1 000		Not commonly used, but technically a more accurate measure of exposure than injuries per 1 000 player-hours, because players are only exposed to tackles when the ball is 'in play'.
Injuries per 1 000 'ball in play and ball-carrier's team in possession' player-hours	13.5	(53/3819)*1 000		Again, not commonly used, but an even closer approximation of actual time exposed to the risk of ball carrier injuries. Players are only tackled when the ball is in play and their team is in possession.
Injuries per 1 000 tackle events	1.2	(53/43366)*1 000	Ball-carrier injury replacements per 1 000 times tackled	Provides an accurate assessment of per-event injury rates, but in isolation ignores frequency of occurrence of the event of interest. Injury rates per event have been sometimes been termed 'injury propensity'. ³

Statistic	Value	Calculation	Explanation	Comment
Injuries per 1 000 players per year	24	(23+17+13)*1 000/ (983+589+627)		Sometimes provided as a gross estimate of injury risk when participant numbers and injury numbers are available, but no measure of exposure for players is available (e.g. data derived from insurance claims combined with registers of participants). Of limited use when exposure varies by subgroup or across sports.

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Daily Medical Report on Injuries and Illnesses

Country:

Date of report:

Form completed by: Name:

Contact details:

Please report: (1) All sport injuries and (2) all illnesses of your athletes newly incurred, recurrent or an exacerbation of an underlying stable injury/illness during the <name of the championship> regardless of the consequences with respect to absence from competition or training. The information provided will be treated strictly confidential.

1. Injury – Example reverse)

Definitions and codes (see

age 22	gender male / female	sport and event decathlon	date of injury 21. July	competition / training sprint competition	code 2	onset code 1	new code 4
injury mechanism slipped and fell		code 5	injured body region ankle		code 17	injury type sprain	
					code 10	time-loss no / yes	duration 28 days

age	gender male / female	sport and event	date of injury	competition / training	code	onset code	new code
injury mechanism		code	injured body region		code	injury type	
					code	time-loss no / yes	duration days

age	gender male / female	sport and event	date of injury	competition / training	code	onset code	new code
injury mechanism		code	injured body region		code	injury type	
					code	time-loss no / yes	duration days

age	gender male / female	sport and event	date of injury	competition / training	code	onset code	new code
injury mechanism		code	injured body region		code	injury type	
					code	time-loss no / yes	duration days

age	gender male / female	sport and event	date of injury	competition / training	code	onset code	new code
injury mechanism		code	injured body region		code	injury type	
					code	time-loss no / yes	duration days

2. Illness – Example reverse)

Definitions and codes (see

age 27	gender male / female	sport and event athletics, pole vault	date of onset 24 th July	organ system / region respiratory system		code 13
aetiology Environmental - not exercise related			code 3	new, recurrent or exacerbation code 1		time-loss no / yes
						duration 2 days

age	gender male / female	sport and event	date of onset	organ system / region		code
aetiology			code	new, recurrent or exacerbation code		time-loss no / yes
						duration days

age	gender male / female	sport and event	date of onset	organ system / region		code
aetiology			code	new, recurrent or exacerbation code		time-loss no / yes
						duration days

age	gender male / female	sport and event	date of onset	organ system / region		code
aetiology			code	new, recurrent or exacerbation code		time-loss no / yes
						duration days

age	gender male / female	sport and event	date of onset	organ system / region		code
aetiology			code	new, recurrent or exacerbation code		time-loss no / yes
						duration days

☐ no new injury or illness in any athlete of our team today

If space is not sufficient to report all injuries or illnesses, please use additional forms.

Definitions and codes

For injuries (defined as tissue damage or other derangement of normal physical function due to participation in sports, resulting from rapid or repetitive transfer of kinetic energy)

Competition or training

1 competition, please specify event

2 training

3 peri-competition activities
(e.g. warm-up, cool-down)

Mode of onset

1 sudden after acute trauma

2 sudden but no acute trauma

3 gradual

4 mixed

Injury mechanism

1 no identifiable single event
(repetitive transfer of energy, overuse)

3 direct contact with another athlete

5 direct contact with an object (e.g. ball,
wall, ground, i.e. slipped and fell)

2 acute non-contact trauma

4 following contact with another
athlete (e.g. fall after a push)

6 following contact with an object

Injured body region

1 head / face

7 shoulder

13 hip / groin

2 neck / cervical spine

8 upper arm

14 thigh

3 chest (incl. chest organs)

9 elbow

15 knee

4 thoracic spine / upper back

10 forearm

16 lower leg / Achilles tendon

5 lumbar-sacral spine / buttock

11 wrist

17 ankle

6 abdomen (incl. abdominal organs)

12 hand

18 foot

Injury type

1 concussion / brain injury

10 joint sprain / ligament tear

19 contusion / bruise (superficial)

2 spinal cord injury

11 chronic instability

20 arthritis

3 peripheral nerve injury

12 tendon rupture

21 bursitis

4 bone fracture

13 tendinopathy

22 synovitis

5 bone stress injury

14 muscle strain / rupture / tear

23 vascular damage

6 bone contusion

15 muscle contusion

24 stump injury

7 avascular necrosis

16 muscle compartment syndrome

25 internal organ trauma

8 physis injury

17 laceration

26 unknown, or not specified

9 cartilage injury

18 abrasion

For illnesses (defined as a complaint or disorder not related to injury)

Organ system

1 cardiovascular

6 genitourinary

11 otological

2 dermatological

7 hematologic

12 psychiatric/psychological

3 dental

8 musculoskeletal

13 respiratory system

4 endocrinology

9 neurological

14 thermoregulatory system

5 gastrointestinal

10 ophthalmological

15 unknown, or not specified

Aetiology

1 allergic

5 infection

9 degenerative or chronic condition

2 environmental - exercise-related

6 neoplasm

10 developmental anomaly

3 environmental - non-exercise

7 metabolic/nutritional

11 drug-related/poisoning

4 immunological/inflammatory

8 thrombotic/haemorrhagic

12 unknown, or not specified

For injuries and illnesses

Sport and event

Please report the sport (e.g. athletics) *AND* specify the event (e.g. pole vault) if applicable.

New, recurrent or exacerbation

1 newly incurred during the championships

3 exacerbation of a stable (not recovered) condition

2 recurrent after full recovery and return-to-sport

4 unknown, or not specified

Time-loss in sport due to injury or illness

no athlete continues to train or compete, even if not at usual level (duration, intensity, performance)

yes athlete *did not finish* the training or competition when the injury occurred *OR* could not participate in sport later

Duration of impaired participation/ limited performance in sport due to injury or illness (in days)

Please provide an estimate of the number of days that the athlete will not be able to undertake his/her *normal training* or will not be able to *compete as usual*, counting the day *after* the onset of the injury/illness as day 1.

Medical Report of Injury or Illness

Date of report: _____

Team: _____ **Athlete identification:** _____ **Date of onset:** _____

For injury

Competition or training

- ☐ competition ☐ training ☐ peri-competition activities
(e.g. warm-up, cool-down)

Mode of onset

- ☐ sudden after acute trauma ☐ sudden but no acute trauma ☐ gradual ☐ mixed

Injury mechanism (each category might have subcategories based on the purpose of the surveillance)

- ☐ no identifiable single event ☐ direct contact with another athlete ☐ direct contact with an object
☐ non-contact trauma ☐ following contact with another athlete ☐ following contact with an object

Injured body region (each category might have subcategories based on the purpose of the surveillance)

- ☐ head ☐ shoulder ☐ hip / groin
☐ neck / cervical spine ☐ upper arm ☐ thigh
☐ chest (incl. chest organs) ☐ elbow ☐ knee
☐ thoracic spine / upper back ☐ forearm ☐ lower leg / Achilles tendon
☐ lumbar-sacral spine / buttock ☐ wrist ☐ ankle
☐ abdomen (incl. abdominal organs) ☐ hand ☐ foot

Injury type

- ☐ concussion / brain injury ☐ joint sprain / ligament tear ☐ contusion / bruise (superficial)
☐ spinal cord injury ☐ chronic instability ☐ arthritis
☐ peripheral nerve injury ☐ tendon rupture ☐ bursitis
☐ bone fracture ☐ tendinopathy ☐ synovitis
☐ bone stress injury ☐ muscle strain / rupture / tear ☐ vascular damage
☐ bone contusion ☐ muscle contusion ☐ stump injury
☐ avascular necrosis ☐ muscle compartment syndrome ☐ internal organ trauma
☐ physis injury ☐ laceration ☐ unknown, or not specified
☐ cartilage injury ☐ abrasion

For illness

Organ system

- ☐ cardiovascular ☐ genitourinary ☐ otological
☐ dermatological ☐ hematologic ☐ psychiatric / psychological
☐ dental ☐ musculoskeletal ☐ respiratory system
☐ endocrinology ☐ neurological ☐ thermoregulatory system
☐ gastrointestinal ☐ ophthalmological ☐ unknown, or not specified

Aetiology

- ☐ allergic ☐ infectious disease ☐ degenerative or chronic condition
☐ environmental - exercise-related ☐ neoplasm ☐ developmental anomaly
☐ environmental - non-exercise ☐ metabolic / nutritional ☐ drug-related / poisoning
☐ immunological / inflammatory ☐ vascular ☐ unknown, or not specified

For injury and illness

New, recurrent or exacerbation

- ☐ new ☐ recurrent after full recovery and return-to-sport ☐ unknown, or not specified
☐ exacerbation of a stable (not recovered) condition

Time-loss in sport due to injury / illness

- ☐ no ☐ yes

Date of full return to normal training and competition _____ (dd/mm/yy)

No return to sport possible: ☐ fatality ☐ permanent disability ☐ other reasons _____

Appendix 3: STROBE-SIIS (Sports Injury and Illness Surveillance) Statement 1.0—Checklist of items for the reporting of observational studies on injury and illness in sports

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract		
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	SIIS-1.1. Include information on the sport, athlete population (sex, age, geographic region) and level of competition. SIIS-1.2. Include the duration of observation (e.g. one season, one year, multiple years).	SIIS-1.1. ‘Study population characteristics’ SIIS-1.2. ‘Capturing and reporting athlete exposure’
		Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported		
Objectives	3	State specific objectives, including any pre-specified hypotheses	SIIS-3.1. State whether study was registered. Identify the registration number and database used.	SIIS-3.1. ‘Reporting guidelines—STROBE Sports Injury and Illness Surveillance (STROBE-SIIS)’
			SIIS-3.2. State the specific purpose of your study (e.g. to describe the injury burden associated with Olympic level rowing)	SIIS-3.2 Throughout consensus statement
Methods				
Study design	4	Present key elements of study design early in the paper	SIIS-4.1. Clearly specify which health problems are being observed.	SIIS-4.1. ‘Defining and classifying health problems’

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
			<p>SIIS-4.2. State explicitly which approach was used to record the health problem data, including all outcome measures or tools</p> <p>SIIS-4.3. State explicitly which coding system was used to classify the health problems (e.g. OSIICS, SMDCS, ICD, etc.)</p> <p>SIIS-4.4. Where relevant, clearly describe how athletes were categorised. Variables to consider could include the type of athlete and/or sport, the environment in which the sport occurs (e.g. type of course or playing area), the typical duration of the sport, the degree of physical contact permitted in the sport, and the equipment permitted.</p>	<p>SIIS-4.2. 'Data collection methods'</p> <p>SIIS-4.3. 'Classifying sports injury and illness diagnoses'</p> <p>SIIS-4.4. 'Study population characteristics'</p>
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	<p>SIIS-5.1. Describe the location, level of play, dates of observation and data collection methods (i.e. who, what, where).</p> <p>SIIS-5.2. Specify the dates of the surveillance period and how the data were handled when the study covered more than one season/calendar year.</p> <p>SIIS-5.3. Define whether the health problem data were collected prospectively or retrospectively.</p>	<p>SIIS-5.1. 'Study population characteristics'</p> <p>SIIS-5.2. 'Capturing and reporting athlete exposure'</p> <p>SIIS-5.3. 'Capturing and reporting athlete exposure' and 'Data collection methods'</p>

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
Participants	6	<p><i>(a) Cohort study</i>—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up</p> <p><i>Case-control study</i>—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls</p> <p><i>Cross-sectional study</i>—Give the eligibility criteria, and the sources and methods of selection of participants</p> <hr/> <p><i>(b) Cohort study</i>—For matched studies, give matching criteria and number of exposed and unexposed</p> <p><i>Case-control study</i>—For matched studies, give matching criteria and the number of controls per case</p>	SIIS-6.1. Define the population of athletes and how they were selected and recruited.	SIIS-6.1. ‘Data collection methods’ and ‘Study population characteristics’
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	<p>SIIS-7.1. Justify why you measured your primary and secondary outcomes of interest in the specific way chosen.</p> <p>SIIS-7.2. Describe the method for identifying your health problem outcome of interest.</p>	<p>SIIS-7.1. ‘Defining and classifying health problems’</p> <p>SIIS-7.2. ‘Defining and classifying health problems’</p>
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe	SIIS-8.1. Specify who collected/reported the data for the	SIIS-8.1. ‘Classifying sports injury and illness diagnoses’ and ‘Data collection methods’

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
		comparability of assessment methods if there is more than one group	<p>study and their qualifications (e.g. qualified doctor, data analyst, etc.).</p> <p>SIIS-8.2. Specify who coded the data for the study and their qualifications (e.g. qualified doctor, data analyst, etc.). In many instances, this will not be the same as SIIS-8.1.</p> <p>SIIS-8.3. Specify the direct methods used to collect the data, and the use of physical documents or an electronic tools. If extracting information from existing sources, specify the data source.</p> <p>SIIS-8.4. Specify the timing of and window for data collection (e.g. day health problem occurred or following day). Specify the frequency of data collection (e.g. daily, weekly, monthly).</p> <p>SIIS-8.5. Report the duration of surveillance (e.g. tournament, season, whole year, playing career).</p>	<p>SIIS-8.2. ‘Classifying sports injury and illness diagnoses’</p> <p>SIIS-8.3. ‘Data collection methods’</p> <p>SIIS-8.4. ‘Relationship to sports activity’ and ‘Capturing and reporting athlete exposure’</p> <p>SIIS-8.5. ‘Relationship to sports activity’ and ‘Capturing and reporting athlete exposure’</p>
Bias	9	Describe any efforts to address potential sources of bias	<p>SIIS-9.1. Clearly report any validation or reliability assessment of the data collection of tools.</p> <p>SIIS-9.2. Formally acknowledge any potential biases in associated with the data collection method (e.g. self-</p>	<p>SIIS-9.1. ‘Data collection methods’</p> <p>SIIS-9.2. ‘Data collection methods’</p>

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
			report, recall bias, reporting by non-medically trained staff, etc.)	
Study size	10	Explain how the study size was arrived at		
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	SIIS-11.1 Explain in detail how multiple injuries/illness episodes are handled both in individual athletes and across athletes/surveillance periods. SIIS-11.2. Specify how injury severity was calculated.	SIIS-11.1. 'Multiple events and health problems' and 'Subsequent, recurrent and/or exacerbation of health problems' SIIS-11.2. 'Severity of health problems'
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	SIIS-12.1. Specify how exposure to risk has been adjusted for and specify the units (e.g. per participant, per athlete exposure, etc.). SIIS-12.2 Specify how relevant risk measures (incidence, prevalence, etc.) were calculated. SIIS-12.3. When relevant to the study aim, specify how injury burden was calculated and analysed.	SIIS-12.1. 'Capturing and reporting athlete exposure' SIIS-12.2 'Expressing risk' SIIS-12.3. 'Burden of health problems'
		(b) Describe any methods used to examine subgroups and interactions		
		(c) Explain how missing data were addressed	SIIS-12.4. For studies reporting multiple health problems, state clearly how these were handled (e.g. time to the first injury only, ignoring	SIIS-12.4. 'Multiple health problems' and 'Subsequent, recurrent and/or exacerbation of injury/illness' SIIS-12.5. 'Capturing and reporting athlete exposure'

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
			subsequent return to play and re-injuries, or modelling of all injuries). SIIS-12.5. Explain how/if athletes not included at outset (e.g. those already injured) were handled in the analyses.	
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	SIIS-12.6. In longitudinal studies, it is particularly important to explain how athlete follow-up has been managed. For example, what happened if a player was transferred to another team or has been censored (for those no longer part of the study due to removal during the observation period). Censoring can occur when athletes are removed due to transfer out of the team/study, injury/illness or due to study design.	SIIS-12.6. ‘Capturing and reporting athlete exposure’
		(e) Describe any sensitivity analyses		
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—e.g. numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	SIIS-13.1. Clearly state the number of athletes followed-up, the number (and %) of those with the health problem and the number of problems reported among them (a median number of problems per affected athlete could be useful). SIIS-13.2. For studies over multiple seasons/years, report the total	SIIS-13.1. ‘Multiple health problems’ SIIS-13.2. ‘Multiple health problems’ and Expressing risk’

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
Descriptive data	14*		numbers of health problems for each year and numbers common to each period.	
		(b) Give reasons for non-participation at each stage	SIIS-13.3. Report how athletes removed (e.g. due to transfer of teams or time-out due to injury or illness) impact upon data at key data collection/reporting points, ideally with a flow diagram	SIIS-13.3. Throughout consensus statement
		(a) Give characteristics of study participants (e.g. demographic, clinical, social) and information on exposures and potential confounders	SIIS-14.1. Include detail on the level of competition being observed (e.g. by age levels, skill level, sex, etc.).	SIIS-14.1. 'Study population characteristics'
		(b) Indicate number of participants with missing data for each variable of interest		
		(c) <i>Cohort study</i> —Summarise follow-up time (e.g. average and total amount)		
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	SIIS-15.1. In many observational studies, individuals will sustain more than one health problem over the surveillance period. Take care to ensure descriptive data representing both the number of health problems and the number of athletes affected. It is important to represent effectively both the analysis and reporting of correct units for frequency data, i.e. the % of affected	SIIS-15.1. 'Multiple health problems' and 'Subsequent, recurrent and/or exacerbation of injury/illness'

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
			athletes or the % of injuries, body regions, etc.	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure		
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures		
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g. 95% confidence interval). Make clear which confounders were adjusted for and why they were included	SIIS-16.1. Report exposure-adjusted incidence or prevalence measures with appropriate confidence intervals when presenting risk measures. SIIS-16.2. Report details of interest, such as mode of onset	SIIS-16.1. ‘Expressing risk’ SIIS-16.2. ‘Relationship to sports activity’, ‘Mode of onset—injury’, ‘Mode of onset—illness’ and ‘Classifying the mechanism of injury’
		(b) Report category boundaries when continuous variables were categorized		
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period		
Other analyses	17	Report other analyses done—e.g. analyses of subgroups and interactions, and sensitivity analyses	SIIS-17.1 Report injury diagnosis information, including region and tissue type in tabular form.	SIIS-17.1. ‘Defining and classifying health problems’
Discussion				
Key results	18	Summarise key results with reference to study objectives		
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or	SIIS-19.1. Discuss limitations in the data collection and coding procedures adopted, including in	SIIS 19.1. ‘Data collection methods’ and ‘Expressing risk’

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
		imprecision. Discuss both direction and magnitude of any potential bias	relation to any risk measures calculated.	
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence		
Generalisability	21	Discuss the generalisability (external validity) of the study results	SIIS-21.1. Discuss the generalizability of the athlete study population, and health problem sub-groups of interest, to broader athlete groups.	SIIS-21.2. 'Relationship to sports activity' and 'Study population characteristics'
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based		
Ethics	23		SIIS-23.1. Outline how individual athlete data privacy and confidentiality considerations were addressed, in line with the Declaration of Helsinki.	SIIS-23.1. 'Research ethics and data security'

Note: The STROBE-SIIS checklist with additional sports epidemiology annotations should be used in conjunction with the original STROBE guideline (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

⁺For brevity, the phrase health problem is used here to encompass both injury and illness.

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

^^ Where there is a blank cell in this column, there are no specific additional reporting requirements for sports injury and illness surveillance over what is already covered in the original STROBE checklist.

Reference

1. Orchard O, Meeuwisse W, Derman W, et al. Refinement and presentation of the Calgary Sport Medicine Diagnostic Coding System (SMDSC) and the Orchard Sport Injury & Illness Classification System (OSIICS). *Br J Sports Med* In preparation

Appendix 1: Case study: Tackle injuries to ball carriers in rugby

The data set

A study was conducted in which video records of every tackle that occurred in 434 professional rugby matches was coded on a range of dimensions, including the location on the body at which the tackler(s) contacted the ball carrier ('tackle height').¹ The information in the table has been restricted to that from 43 366 tackles in which a single tackler tackled a ball carrier (i.e. the 100 tackle events per match that met this criteria). For the purposes of the example below, an injury is defined as 'any injury sustained by a ball carrier during a rugby tackle that required them to be removed from the field of play for the remainder of the match'.

Different denominators: different perspectives on risk

Rates of injury have been presented in Table 1 as 'per 10 000 tackles' and 'per 10 000 player-hours'. If data were reported using only the time-based denominator, as has been the case in most studies of sports injury epidemiology, the conclusion drawn would be that 'high' and 'middle' tackles are those that carry the greatest risk to ball carriers. When the relative frequency of the tackles is considered, and the rates are presented on a 'per 10 000 tackles' basis, head/neck tackles place ball carriers at the greatest risk of injury *when they occur*.

Table 1 Injury rates to ball carriers in rugby tackles, expressed via event-based and time-based denominators.

Injuries requiring the player to be removed from the match				
Tackle height	Tackles per match	Per 10 000 tackles	Per 10 000 player-hours	Percent of injuries per 10 000 player hours
Head/neck	4 ± 2	43 (23 to 79)	4 (2 to 8)	13 (7 to 23)
High	37 ± 10	12 (8 to 17)	11 (8 to 16)	36 (26 to 47)
Middle	44 ± 9	9 (6 to 13)	10 (7 to 15)	32 (23 to 43)
Low	15 ± 5	16 (9 to 26)	6 (3 to 10)	19 (12 to 29)

The different perspectives provided by 'per-event' and 'per-time' denominators can be helpful in identifying injury prevention priorities. If the overall risk of injuries was considered 'unacceptably high' by those responsible for managing the risks in the sport, then reducing the numbers of the most

common tackles in the game would have the greatest effect; together ‘high’ and ‘middle’ tackles account for over two-thirds of all tackle injuries requiring ball carriers to be removed from the pitch. Reducing the numbers of such tackles, or the characteristics of them, would probably require major changes to the sport of rugby. If, however, the overall degree of risk was considered ‘acceptable’, then focussing on decreasing the number of ‘head and neck’ tackles would have a modest effect on overall injury rates, but reduce the occurrence of a particularly risky element of the sport (note: head/neck tackles are not permitted within the laws of rugby, but sometimes occur).

The type of exposure measures that can form the basis of risk statistics is presented in Table 2, along with a range of the risk measures that have been reported in studies of team sports injury epidemiology. The examples are taken from the same study discussed above.

Table 2 A range of exposure and risk statistics derived from injury surveillance data - examples from a study of rugby tackle injuries.¹

Statistic	Value	Calculation	Explanation	Comment
Injury statistics				
Number of injuries (carrier injury replacements in 434 matches)	53	Nil	Count of the number of tackler injuries requiring the injured player to be replaced observed in 434 matches.	The ‘numerator’ used for calculating the rate of tackler replacement injuries per unit of time or per tackle. Absolute numbers and costs of injuries <i>are</i> of interest to risk managers, especially when provided in parallel with rates
Number of injured players (some were injured more than once)	48	Nil		The numerator for calculating ‘injury risk’
Exposure measures				
Player hours in 434 matches	17 360	30*579	Thirty players (15 from each team) multiplied by 579 (hours of play in 434 matches of 80 minutes duration)	This number provides a ‘time-window’ denominator. Usually it is assumed that time lost for yellow and red cards, or time gained for ‘extra time’ is negligible and is ignored.
Number of single tackler tackle events in 434 matches	43 366	Nil	All tackles in 434 matches were coded, regardless of whether they resulted in injury	This number forms an ‘event-based’ denominator.

Statistic	Value	Calculation	Explanation	Comment
Number of players who appeared in the 434 matches	1403	Nil		This is a count of the size of the cohort across the entire study period; it is used as the denominator for calculating 'injury risk'.
Number of full player matches	13 020	30*434	Thirty players (15 from each team) multiplied by 434 matches	This number provides a 'per-match' denominator.
Number of athlete-exposures (athlete-participations)	17 685	Nil	Count of the number of players who took the field over 434 matches (players can be substituted for tactical purposes or replaced due to injury)	The similarity to the number of player hours is coincidental; there are 40 hours of player-time per match, and the average number of athlete exposures per match over this series of matches was 40.8.
Risk measures				
Period prevalence (percentage of cohort injured)	3%	(48/1403)*100	Percentage of people who appeared in matches who were replaced	Often reported as 'risk per season' or 'risk per year'. Can't be easily used to compare between activities if the duration of surveillance varies from activity to activity. The longer the surveillance period, the higher the risk will appear to be for closed cohorts
Injuries per 1 000 player-hours	3.1	(53/17 360)*1 000	The number of injuries is divided by the number of hours of player exposure, and multiplied by a scaling factor (e.g. 1 000, 10 000) to provide a rate that is convenient to work with (e.g. numbers in the range of 1	The most commonly reported metric of injury rates in studies of rugby injury epidemiology has been rate of injuries per 1 000 player-hours. This convention is endorsed in the consensus document by Fuller et al. ²

Statistic	Value	Calculation	Explanation	Comment
			to 1 000 rather than numbers less than zero or greater than 1 000	It is relatively simple to estimate based on the number of matches played. Comparisons of incidence rates between activities or within activities over time based on this denominator require the assumption that the number and characteristics of energy transfers to which participants are exposed remains relatively constant per unit of exposure time.
Injuries per 1 000 matches	122	$(53/434)*1\,000$	Rate of tackler replacements per rugby union match multiplied by 1 000. The rate per match is multiplied by a factor that provides a convenient interpretation; 0.12 carrier replacement injuries per match; 12.2 per 100 matches, 122 per 1 000 matches etc.	Ignores number of players and match duration, and provides an estimate of the number of injuries an observer would expect to see if they watched 1 000 matches. Not useful for comparing incidence rates between activities of differing durations or numbers of participants.
Injuries per 1 000 hours of play (ignoring number of players)	92	$(53/579)*1\,000$	The rate per hour is multiplied by a factor that provides a convenient interpretation; 0.9 carrier replacement injuries per hour; 9.2 per 100 hours, 92 per 1 000 hours etc.	Ignores number of players, and provides an estimate of the number of injuries an observer would expect to see if they watched 1 000 hours of play. Not useful for comparing between activities with differing numbers of participants (because the sizes of the populations at risk differ)
Injuries per 1 000 athlete-exposures	3.0	$(53/17685)*1\,000$	Carrier injury replacements per 1 000 athlete exposures	Injuries per 1 000 athlete exposures are commonly reported in injury surveillance in the United States. Problematic for comparing between activities that

Statistic	Value	Calculation	Explanation	Comment
(athlete-participations)				have different numbers of typical athlete exposures per match, or when the average exposure time per player changes over time.
Injuries per 1 000 full player matches	4.1	$(53/13020)*1\ 000$		Not commonly used. It ignores the duration of the match, and as such has similar drawbacks to reporting injuries per athlete exposure, because the time-window of exposure varies between activities of different durations.
Injuries per 1 000 'ball in play' player-hours	6.8	$(53/7740)*1\ 000$		Not commonly used, but technically a more accurate measure of exposure than injuries per 1 000 player-hours, because players are only exposed to tackles when the ball is 'in play'.
Injuries per 1 000 'ball in play and ball-carrier's team in possession' player-hours	13.5	$(53/3819)*1\ 000$		Again, not commonly used, but an even closer approximation of actual time exposed to the risk of ball carrier injuries. Players are only tackled when the ball is in play and their team is in possession.
Injuries per 1 000 tackle events	1.2	$(53/43366)*1\ 000$	Ball-carrier injury replacements per 1 000 times tackled	Provides an accurate assessment of per-event injury rates, but in isolation ignores frequency of occurrence of the event of interest. Injury rates per event have been sometimes been termed 'injury propensity'. ³

Statistic	Value	Calculation	Explanation	Comment
Injuries per 1 000 players per year	24	(23+17+13)*1 000/ (983+589+627)		Sometimes provided as a gross estimate of injury risk when participant numbers and injury numbers are available, but no measure of exposure for players is available (e.g. data derived from insurance claims combined with registers of participants). Of limited use when exposure varies by subgroup or across sports.

References

1. Quarrie KL, Hopkins WG. Tackle injuries in professional Rugby Union. *Am J Sports Med* 2008;36(9):1705-16. doi: 10.1177/0363546508316768 [published Online First: 2008/05/23]
2. Fuller CW, Molloy MG, Bagate C, et al. Consensus statement on injury definitions and data collection procedures for studies of injuries in rugby union. *Br J Sports Med* 2007;41(5):328-31. doi: 10.1136/bjism.2006.033282
3. Fuller CW, Brooks JH, Cancea RJ, et al. Contact events in rugby union and their propensity to cause injury. *Br J Sports Med* 2007;41:862-67.

Daily Medical Report on Injuries and Illnesses

Country:

Date of report:

Form completed by: Name:

Contact details:

Please report: (1) All sport injuries and (2) all illnesses of your athletes newly incurred, recurrent or an exacerbation of an underlying stable injury/illness during the <name of the championship> regardless of the consequences with respect to absence from competition or training. The information provided will be treated strictly confidential.

1. Injury – Example reverse)

Definitions and codes (see

age 22	gender male / female	sport and event decathlon	date of injury 21. July	competition / training sprint competition	code 2	onset code 1	new code 4		
injury mechanism slipped and fell		code 5	injured body region ankle	code 17	injury type sprain		code 10	time-loss no / yes	duration 28 days

age	gender male / female	sport and event	date of injury	competition / training	code	onset code	new code		
injury mechanism		code	injured body region	code	injury type		code	time-loss no / yes	duration days

age	gender male / female	sport and event	date of injury	competition / training	code	onset code	new code		
injury mechanism		code	injured body region	code	injury type		code	time-loss no / yes	duration days

age	gender male / female	sport and event	date of injury	competition / training	code	onset code	new code		
injury mechanism		code	injured body region	code	injury type		code	time-loss no / yes	duration days

age	gender male / female	sport and event	date of injury	competition / training	code	onset code	new code		
injury mechanism		code	injured body region	code	injury type		code	time-loss no / yes	duration days

age	gender male / female	sport and event	date of injury	competition / training	code	onset code	new code		
injury mechanism		code	injured body region	code	injury type		code	time-loss no / yes	duration days

2. Illness – Example reverse)

Definitions and codes (see

age 27	gender male / female	sport and event athletics, pole vault	date of onset 24 th July	organ system / region respiratory system		code 13	
aetiology Environmental - not exercise related			code 3	new, recurrent or exacerbation code 1		time-loss no / yes	duration 2 days

age	gender male / female	sport and event	date of onset	organ system / region		code	
aetiology			code	new, recurrent or exacerbation code		time-loss no / yes	duration days

age	gender male / female	sport and event	date of onset	organ system / region		code	
aetiology			code	new, recurrent or exacerbation code		time-loss no / yes	duration days

age	gender male / female	sport and event	date of onset	organ system / region		code	
aetiology			code	new, recurrent or exacerbation code		time-loss no / yes	duration days

age	gender male / female	sport and event	date of onset	organ system / region		code	
aetiology			code	new, recurrent or exacerbation code		time-loss no / yes	duration days

☐ no new injury or illness in any athlete of our team today

If space is not sufficient to report all injuries or illnesses, please use additional forms.

Definitions and codes

For injuries (defined as tissue damage or other derangement of normal physical function due to participation in sports, resulting from rapid or repetitive transfer of kinetic energy)

Competition or training

1 competition, please specify event

2 training

3 peri-competition activities
(e.g. warm-up, cool-down)

Mode of onset

1 sudden after acute trauma

2 sudden but no acute trauma

3 gradual

4 mixed

Injury mechanism

1 no identifiable single event
(repetitive transfer of energy, overuse)

3 direct contact with another athlete
4 following contact with another athlete (e.g. fall after a push)

5 direct contact with an object (e.g. ball, wall, ground, i.e. slipped and fell)
6 following contact with an object

Injured body region

1 head / face

7 shoulder

13 hip / groin

2 neck / cervical spine

8 upper arm

14 thigh

3 chest (incl. chest organs)

9 elbow

15 knee

4 thoracic spine / upper back

10 forearm

16 lower leg / Achilles tendon

5 lumbar-sacral spine / buttock

11 wrist

17 ankle

6 abdomen (incl. abdominal organs)

12 hand

18 foot

Injury type

1 concussion / brain injury

10 joint sprain / ligament tear

19 contusion / bruise (superficial)

2 spinal cord injury

11 chronic instability

20 arthritis

3 peripheral nerve injury

12 tendon rupture

21 bursitis

4 bone fracture

13 tendinopathy

22 synovitis

5 bone stress injury

14 muscle strain / rupture / tear

23 vascular damage

6 bone contusion

15 muscle contusion

24 stump injury

7 avascular necrosis

16 muscle compartment syndrome

25 internal organ trauma

8 physis injury

17 laceration

26 unknown, or not specified

9 cartilage injury

18 abrasion

For illnesses (defined as a complaint or disorder not related to injury)

Organ system

1 cardiovascular

6 genitourinary

11 otological

2 dermatological

7 hematologic

12 psychiatric/psychological

3 dental

8 musculoskeletal

13 respiratory system

4 endocrinology

9 neurological

14 thermoregulatory system

5 gastrointestinal

10 ophthalmological

15 unknown, or not specified

Aetiology

1 allergic

5 infection

9 degenerative or chronic condition

2 environmental - exercise-related

6 neoplasm

10 developmental anomaly

3 environmental - non-exercise

7 metabolic/nutritional

11 drug-related/poisoning

4 immunological/inflammatory

8 thrombotic/haemorrhagic

12 unknown, or not specified

For injuries and illnesses

Sport and event

Please report the sport (e.g. athletics) *AND* specify the event (e.g. pole vault) if applicable.

New, recurrent or exacerbation

1 newly incurred during the championships

3 exacerbation of a stable (not recovered) condition

2 recurrent after full recovery and return-to-sport

4 unknown, or not specified

Time-loss in sport due to injury or illness

no athlete continues to train or compete, even if not at usual level (duration, intensity, performance)

yes athlete *did not finish* the training or competition when the injury occurred *OR* could not participate in sport later

Duration of impaired participation/ limited performance in sport due to injury or illness (in days)

Please provide an estimate of the number of days that the athlete will not be able to undertake his/her *normal training* or will not be able to *compete as usual*, counting the day *after* the onset of the injury/illness as day 1.

Medical Report of Injury or Illness

Date of report: _____

Team: _____ **Athlete identification:** _____ **Date of onset:** _____

For injury

Competition or training

- ☐ competition ☐ training ☐ peri-competition activities
(e.g. warm-up, cool-down)

Mode of onset

- ☐ sudden after acute trauma ☐ sudden but no acute trauma ☐ gradual ☐ mixed

Injury mechanism (each category might have subcategories based on the purpose of the surveillance)

- ☐ no identifiable single event ☐ direct contact with another athlete ☐ direct contact with an object
☐ non-contact trauma ☐ following contact with another athlete ☐ following contact with an object

Injured body region (each category might have subcategories based on the purpose of the surveillance)

- ☐ head ☐ shoulder ☐ hip / groin
☐ neck / cervical spine ☐ upper arm ☐ thigh
☐ chest (incl. chest organs) ☐ elbow ☐ knee
☐ thoracic spine / upper back ☐ forearm ☐ lower leg / Achilles tendon
☐ lumbar-sacral spine / buttock ☐ wrist ☐ ankle
☐ abdomen (incl. abdominal organs) ☐ hand ☐ foot

Injury type

- ☐ concussion / brain injury ☐ joint sprain / ligament tear ☐ contusion / bruise (superficial)
☐ spinal cord injury ☐ chronic instability ☐ arthritis
☐ peripheral nerve injury ☐ tendon rupture ☐ bursitis
☐ bone fracture ☐ tendinopathy ☐ synovitis
☐ bone stress injury ☐ muscle strain / rupture / tear ☐ vascular damage
☐ bone contusion ☐ muscle contusion ☐ stump injury
☐ avascular necrosis ☐ muscle compartment syndrome ☐ internal organ trauma
☐ physis injury ☐ laceration ☐ unknown, or not specified
☐ cartilage injury ☐ abrasion

For illness

Organ system

- ☐ cardiovascular ☐ genitourinary ☐ otological
☐ dermatological ☐ hematologic ☐ psychiatric / psychological
☐ dental ☐ musculoskeletal ☐ respiratory system
☐ endocrinology ☐ neurological ☐ thermoregulatory system
☐ gastrointestinal ☐ ophthalmological ☐ unknown, or not specified

Aetiology

- ☐ allergic ☐ infectious disease ☐ degenerative or chronic condition
☐ environmental - exercise-related ☐ neoplasm ☐ developmental anomaly
☐ environmental - non-exercise ☐ metabolic / nutritional ☐ drug-related / poisoning
☐ immunological / inflammatory ☐ vascular ☐ unknown, or not specified

For injury and illness

New, recurrent or exacerbation

- ☐ new ☐ recurrent after full recovery and return-to-sport ☐ unknown, or not specified
☐ exacerbation of a stable (not recovered) condition

Time-loss in sport due to injury / illness

- ☐ no ☐ yes

Date of full return to normal training and competition _____ (dd/mm/yy)

No return to sport possible: ☐ fatality ☐ permanent disability ☐ other reasons _____

Appendix 3: STROBE-SIIS (Sports Injury and Illness Surveillance) Statement 1.0—Checklist of items for the reporting of observational studies on injury and illness in sports

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract		
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	SIIS-1.1. Include information on the sport, athlete population (sex, age, geographic region) and level of competition. SIIS-1.2. Include the duration of observation (e.g. one season, one year, multiple years).	SIIS-1.1. ‘Study population characteristics’ SIIS-1.2. ‘Capturing and reporting athlete exposure’
		Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported		
Objectives	3	State specific objectives, including any pre-specified hypotheses	SIIS-3.1. State whether study was registered. Identify the registration number and database used.	SIIS-3.1. ‘Reporting guidelines—STROBE Sports Injury and Illness Surveillance (STROBE-SIIS)’
			SIIS-3.2. State the specific purpose of your study (e.g. to describe the injury burden associated with Olympic level rowing)	SIIS-3.2 Throughout consensus statement
Methods				
Study design	4	Present key elements of study design early in the paper	SIIS-4.1. Clearly specify which health problems are being observed.	SIIS-4.1. ‘Defining and classifying health problems’

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
			<p>SIIS-4.2. State explicitly which approach was used to record the health problem data, including all outcome measures or tools</p> <p>SIIS-4.3. State explicitly which coding system was used to classify the health problems (e.g. OSIICS, SMDCS, ICD, etc.)</p> <p>SIIS-4.4. Where relevant, clearly describe how athletes were categorised. Variables to consider could include the type of athlete and/or sport, the environment in which the sport occurs (e.g. type of course or playing area), the typical duration of the sport, the degree of physical contact permitted in the sport, and the equipment permitted.</p>	<p>SIIS-4.2. 'Data collection methods'</p> <p>SIIS-4.3. 'Classifying sports injury and illness diagnoses'</p> <p>SIIS-4.4. 'Study population characteristics'</p>
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	<p>SIIS-5.1. Describe the location, level of play, dates of observation and data collection methods (i.e. who, what, where).</p> <p>SIIS-5.2. Specify the dates of the surveillance period and how the data were handled when the study covered more than one season/calendar year.</p> <p>SIIS-5.3. Define whether the health problem data were collected prospectively or retrospectively.</p>	<p>SIIS-5.1. 'Study population characteristics'</p> <p>SIIS-5.2. 'Capturing and reporting athlete exposure'</p> <p>SIIS-5.3. 'Capturing and reporting athlete exposure' and 'Data collection methods'</p>

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
Participants	6	<p><i>(a) Cohort study</i>—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up</p> <p><i>Case-control study</i>—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls</p> <p><i>Cross-sectional study</i>—Give the eligibility criteria, and the sources and methods of selection of participants</p> <hr/> <p><i>(b) Cohort study</i>—For matched studies, give matching criteria and number of exposed and unexposed</p> <p><i>Case-control study</i>—For matched studies, give matching criteria and the number of controls per case</p>	SIIS-6.1. Define the population of athletes and how they were selected and recruited.	SIIS-6.1. ‘Data collection methods’ and ‘Study population characteristics’
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	<p>SIIS-7.1. Justify why you measured your primary and secondary outcomes of interest in the specific way chosen.</p> <p>SIIS-7.2. Describe the method for identifying your health problem outcome of interest.</p>	<p>SIIS-7.1. ‘Defining and classifying health problems’</p> <p>SIIS-7.2. ‘Defining and classifying health problems’</p>
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe	SIIS-8.1. Specify who collected/reported the data for the	SIIS-8.1. ‘Classifying sports injury and illness diagnoses’ and ‘Data collection methods’

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
		comparability of assessment methods if there is more than one group	<p>study and their qualifications (e.g. qualified doctor, data analyst, etc.).</p> <p>SIIS-8.2. Specify who coded the data for the study and their qualifications (e.g. qualified doctor, data analyst, etc.). In many instances, this will not be the same as SIIS-8.1.</p> <p>SIIS-8.3. Specify the direct methods used to collect the data, and the use of physical documents or an electronic tools. If extracting information from existing sources, specify the data source.</p> <p>SIIS-8.4. Specify the timing of and window for data collection (e.g. day health problem occurred or following day). Specify the frequency of data collection (e.g. daily, weekly, monthly).</p> <p>SIIS-8.5. Report the duration of surveillance (e.g. tournament, season, whole year, playing career).</p>	<p>SIIS-8.2. 'Classifying sports injury and illness diagnoses'</p> <p>SIIS-8.3. 'Data collection methods'</p> <p>SIIS-8.4. 'Relationship to sports activity' and 'Capturing and reporting athlete exposure'</p> <p>SIIS-8.5. 'Relationship to sports activity' and 'Capturing and reporting athlete exposure'</p>
Bias	9	Describe any efforts to address potential sources of bias	<p>SIIS-9.1. Clearly report any validation or reliability assessment of the data collection of tools.</p> <p>SIIS-9.2. Formally acknowledge any potential biases in associated with the data collection method (e.g. self-</p>	<p>SIIS-9.1. 'Data collection methods'</p> <p>SIIS-9.2. 'Data collection methods'</p>

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
			report, recall bias, reporting by non-medically trained staff, etc.)	
Study size	10	Explain how the study size was arrived at		
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	<p>SIIS-11.1 Explain in detail how multiple injuries/illness episodes are handled both in individual athletes and across athletes/surveillance periods.</p> <p>SIIS-11.2. Specify how injury severity was calculated.</p>	<p>SIIS-11.1. 'Multiple events and health problems' and 'Subsequent, recurrent and/or exacerbation of health problems'</p> <p>SIIS-11.2. 'Severity of health problems'</p>
Statistical methods	12	<p>(a) Describe all statistical methods, including those used to control for confounding</p> <p>(b) Describe any methods used to examine subgroups and interactions</p> <p>(c) Explain how missing data were addressed</p>	<p>SIIS-12.1. Specify how exposure to risk has been adjusted for and specify the units (e.g. per participant, per athlete exposure, etc.).</p> <p>SIIS-12.2 Specify how relevant risk measures (incidence, prevalence, etc.) were calculated.</p> <p>SIIS-12.3. When relevant to the study aim, specify how injury burden was calculated and analysed.</p>	<p>SIIS-12.1. 'Capturing and reporting athlete exposure'</p> <p>SIIS-12.2 'Expressing risk'</p> <p>SIIS-12.3. 'Burden of health problems'</p> <p>SIIS-12.4. 'Multiple health problems' and 'Subsequent, recurrent and/or exacerbation of injury/illness'</p> <p>SIIS-12.5. 'Capturing and reporting athlete exposure'</p>

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
			subsequent return to play and re-injuries, or modelling of all injuries). SIIS-12.5. Explain how/if athletes not included at outset (e.g. those already injured) were handled in the analyses.	
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	SIIS-12.6. In longitudinal studies, it is particularly important to explain how athlete follow-up has been managed. For example, what happened if a player was transferred to another team or has been censored (for those no longer part of the study due to removal during the observation period). Censoring can occur when athletes are removed due to transfer out of the team/study, injury/illness or due to study design.	SIIS-12.6. ‘Capturing and reporting athlete exposure’
		(e) Describe any sensitivity analyses		
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—e.g. numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	SIIS-13.1. Clearly state the number of athletes followed-up, the number (and %) of those with the health problem and the number of problems reported among them (a median number of problems per affected athlete could be useful). SIIS-13.2. For studies over multiple seasons/years, report the total	SIIS-13.1. ‘Multiple health problems’ SIIS-13.2. ‘Multiple health problems’ and Expressing risk’

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
			numbers of health problems for each year and numbers common to each period.	
		(b) Give reasons for non-participation at each stage	SIIS-13.3. Report how athletes removed (e.g. due to transfer of teams or time-out due to injury or illness) impact upon data at key data collection/reporting points, ideally with a flow diagram	SIIS-13.3. Throughout consensus statement
Descriptive data	14*	(a) Give characteristics of study participants (e.g. demographic, clinical, social) and information on exposures and potential confounders	SIIS-14.1. Include detail on the level of competition being observed (e.g. by age levels, skill level, sex, etc.).	SIIS-14.1. 'Study population characteristics'
		(b) Indicate number of participants with missing data for each variable of interest		
		(c) <i>Cohort study</i> —Summarise follow-up time (e.g. average and total amount)		
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	SIIS-15.1. In many observational studies, individuals will sustain more than one health problem over the surveillance period. Take care to ensure descriptive data representing both the number of health problems and the number of athletes affected. It is important to represent effectively both the analysis and reporting of correct units for frequency data, i.e. the % of affected	SIIS-15.1. 'Multiple health problems' and 'Subsequent, recurrent and/or exacerbation of injury/illness'

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
			athletes or the % of injuries, body regions, etc.	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure		
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures		
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g. 95% confidence interval). Make clear which confounders were adjusted for and why they were included	SIIS-16.1. Report exposure-adjusted incidence or prevalence measures with appropriate confidence intervals when presenting risk measures. SIIS-16.2. Report details of interest, such as mode of onset	SIIS-16.1. ‘Expressing risk’ SIIS-16.2. ‘Relationship to sports activity’, ‘Mode of onset—injury’, ‘Mode of onset—illness’ and ‘Classifying the mechanism of injury’
		(b) Report category boundaries when continuous variables were categorized		
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period		
Other analyses	17	Report other analyses done—e.g. analyses of subgroups and interactions, and sensitivity analyses	SIIS-17.1 Report injury diagnosis information, including region and tissue type in tabular form.	SIIS-17.1. ‘Defining and classifying health problems’
Discussion				
Key results	18	Summarise key results with reference to study objectives		
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or	SIIS-19.1. Discuss limitations in the data collection and coding procedures adopted, including in	SIIS 19.1. ‘Data collection methods’ and ‘Expressing risk’

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
		imprecision. Discuss both direction and magnitude of any potential bias	relation to any risk measures calculated.	
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence		
Generalisability	21	Discuss the generalisability (external validity) of the study results	SIIS-21.1. Discuss the generalizability of the athlete study population, and health problem sub-groups of interest, to broader athlete groups.	SIIS-21.2. 'Relationship to sports activity' and 'Study population characteristics'
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based		
Ethics	23		SIIS-23.1. Outline how individual athlete data privacy and confidentiality considerations were addressed, in line with the Declaration of Helsinki.	SIIS-23.1. 'Research ethics and data security'

Note: The STROBE-SIIS checklist with additional sports epidemiology annotations should be used in conjunction with the original STROBE guideline (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

⁺For brevity, the phrase health problem is used here to encompass both injury and illness.

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

^^ Where there is a blank cell in this column, there are no specific additional reporting requirements for sports injury and illness surveillance over what is already covered in the original STROBE checklist.

Reference

1. Orchard O, Meeuwisse W, Derman W, et al. Refinement and presentation of the Calgary Sport Medicine Diagnostic Coding System (SMDSC) and the Orchard Sport Injury & Illness Classification System (OSIICS). *Br J Sports Med* In preparation

Appendix 1: Case study: Tackle injuries to ball carriers in rugby

The data set

A study was conducted in which video records of every tackle that occurred in 434 professional rugby matches was coded on a range of dimensions, including the location on the body at which the tackler(s) contacted the ball carrier ('tackle height').¹ The information in the table has been restricted to that from 43 366 tackles in which a single tackler tackled a ball carrier (i.e. the 100 tackle events per match that met this criteria). For the purposes of the example below, an injury is defined as 'any injury sustained by a ball carrier during a rugby tackle that required them to be removed from the field of play for the remainder of the match'.

Different denominators: different perspectives on risk

Rates of injury have been presented in Table 1 as 'per 10 000 tackles' and 'per 10 000 player-hours'. If data were reported using only the time-based denominator, as has been the case in most studies of sports injury epidemiology, the conclusion drawn would be that 'high' and 'middle' tackles are those that carry the greatest risk to ball carriers. When the relative frequency of the tackles is considered, and the rates are presented on a 'per 10 000 tackles' basis, head/neck tackles place ball carriers at the greatest risk of injury *when they occur*.

Table 1 Injury rates to ball carriers in rugby tackles, expressed via event-based and time-based denominators.

Injuries requiring the player to be removed from the match				
Tackle height	Tackles per match	Per 10 000 tackles	Per 10 000 player-hours	Percent of injuries per 10 000 player hours
Head/neck	4 ± 2	43 (23 to 79)	4 (2 to 8)	13 (7 to 23)
High	37 ± 10	12 (8 to 17)	11 (8 to 16)	36 (26 to 47)
Middle	44 ± 9	9 (6 to 13)	10 (7 to 15)	32 (23 to 43)
Low	15 ± 5	16 (9 to 26)	6 (3 to 10)	19 (12 to 29)

The different perspectives provided by 'per-event' and 'per-time' denominators can be helpful in identifying injury prevention priorities. If the overall risk of injuries was considered 'unacceptably high' by those responsible for managing the risks in the sport, then reducing the numbers of the most

common tackles in the game would have the greatest effect; together ‘high’ and ‘middle’ tackles account for over two-thirds of all tackle injuries requiring ball carriers to be removed from the pitch. Reducing the numbers of such tackles, or the characteristics of them, would probably require major changes to the sport of rugby. If, however, the overall degree of risk was considered ‘acceptable’, then focussing on decreasing the number of ‘head and neck’ tackles would have a modest effect on overall injury rates, but reduce the occurrence of a particularly risky element of the sport (note: head/neck tackles are not permitted within the laws of rugby, but sometimes occur).

The type of exposure measures that can form the basis of risk statistics is presented in Table 2, along with a range of the risk measures that have been reported in studies of team sports injury epidemiology. The examples are taken from the same study discussed above.

Table 2 A range of exposure and risk statistics derived from injury surveillance data - examples from a study of rugby tackle injuries.¹

Statistic	Value	Calculation	Explanation	Comment
Injury statistics				
Number of injuries (carrier injury replacements in 434 matches)	53	Nil	Count of the number of tackler injuries requiring the injured player to be replaced observed in 434 matches.	The ‘numerator’ used for calculating the rate of tackler replacement injuries per unit of time or per tackle. Absolute numbers and costs of injuries <i>are</i> of interest to risk managers, especially when provided in parallel with rates
Number of injured players (some were injured more than once)	48	Nil		The numerator for calculating ‘injury risk’
Exposure measures				
Player hours in 434 matches	17 360	30*579	Thirty players (15 from each team) multiplied by 579 (hours of play in 434 matches of 80 minutes duration)	This number provides a ‘time-window’ denominator. Usually it is assumed that time lost for yellow and red cards, or time gained for ‘extra time’ is negligible and is ignored.
Number of single tackler tackle events in 434 matches	43 366	Nil	All tackles in 434 matches were coded, regardless of whether they resulted in injury	This number forms an ‘event-based’ denominator.

Statistic	Value	Calculation	Explanation	Comment
Number of players who appeared in the 434 matches	1403	Nil		This is a count of the size of the cohort across the entire study period; it is used as the denominator for calculating 'injury risk'.
Number of full player matches	13 020	30*434	Thirty players (15 from each team) multiplied by 434 matches	This number provides a 'per-match' denominator.
Number of athlete-exposures (athlete-participations)	17 685	Nil	Count of the number of players who took the field over 434 matches (players can be substituted for tactical purposes or replaced due to injury)	The similarity to the number of player hours is coincidental; there are 40 hours of player-time per match, and the average number of athlete exposures per match over this series of matches was 40.8.
Risk measures				
Period prevalence (percentage of cohort injured)	3%	(48/1403)*100	Percentage of people who appeared in matches who were replaced	Often reported as 'risk per season' or 'risk per year'. Can't be easily used to compare between activities if the duration of surveillance varies from activity to activity. The longer the surveillance period, the higher the risk will appear to be for closed cohorts
Injuries per 1 000 player-hours	3.1	(53/17 360)*1 000	The number of injuries is divided by the number of hours of player exposure, and multiplied by a scaling factor (e.g. 1 000, 10 000) to provide a rate that is convenient to work with (e.g. numbers in the range of 1	The most commonly reported metric of injury rates in studies of rugby injury epidemiology has been rate of injuries per 1 000 player-hours. This convention is endorsed in the consensus document by Fuller et al. ²

Statistic	Value	Calculation	Explanation	Comment
			to 1 000 rather than numbers less than zero or greater than 1 000	It is relatively simple to estimate based on the number of matches played. Comparisons of incidence rates between activities or within activities over time based on this denominator require the assumption that the number and characteristics of energy transfers to which participants are exposed remains relatively constant per unit of exposure time.
Injuries per 1 000 matches	122	$(53/434)*1\ 000$	Rate of tackler replacements per rugby union match multiplied by 1 000. The rate per match is multiplied by a factor that provides a convenient interpretation; 0.12 carrier replacement injuries per match; 12.2 per 100 matches, 122 per 1 000 matches etc.	Ignores number of players and match duration, and provides an estimate of the number of injuries an observer would expect to see if they watched 1 000 matches. Not useful for comparing incidence rates between activities of differing durations or numbers of participants.
Injuries per 1 000 hours of play (ignoring number of players)	92	$(53/579)*1\ 000$	The rate per hour is multiplied by a factor that provides a convenient interpretation; 0.9 carrier replacement injuries per hour; 9.2 per 100 hours, 92 per 1 000 hours etc.	Ignores number of players, and provides an estimate of the number of injuries an observer would expect to see if they watched 1 000 hours of play. Not useful for comparing between activities with differing numbers of participants (because the sizes of the populations at risk differ)
Injuries per 1 000 athlete-exposures	3.0	$(53/17685)*1\ 000$	Carrier injury replacements per 1 000 athlete exposures	Injuries per 1 000 athlete exposures are commonly reported in injury surveillance in the United States. Problematic for comparing between activities that

Statistic	Value	Calculation	Explanation	Comment
(athlete-participations)				have different numbers of typical athlete exposures per match, or when the average exposure time per player changes over time.
Injuries per 1 000 full player matches	4.1	$(53/13020)*1\ 000$		Not commonly used. It ignores the duration of the match, and as such has similar drawbacks to reporting injuries per athlete exposure, because the time-window of exposure varies between activities of different durations.
Injuries per 1 000 'ball in play' player-hours	6.8	$(53/7740)*1\ 000$		Not commonly used, but technically a more accurate measure of exposure than injuries per 1 000 player-hours, because players are only exposed to tackles when the ball is 'in play'.
Injuries per 1 000 'ball in play and ball-carrier's team in possession' player-hours	13.5	$(53/3819)*1\ 000$		Again, not commonly used, but an even closer approximation of actual time exposed to the risk of ball carrier injuries. Players are only tackled when the ball is in play and their team is in possession.
Injuries per 1 000 tackle events	1.2	$(53/43366)*1\ 000$	Ball-carrier injury replacements per 1 000 times tackled	Provides an accurate assessment of per-event injury rates, but in isolation ignores frequency of occurrence of the event of interest. Injury rates per event have been sometimes been termed 'injury propensity'. ³

Statistic	Value	Calculation	Explanation	Comment
Injuries per 1 000 players per year	24	(23+17+13)*1 000/ (983+589+627)		Sometimes provided as a gross estimate of injury risk when participant numbers and injury numbers are available, but no measure of exposure for players is available (e.g. data derived from insurance claims combined with registers of participants). Of limited use when exposure varies by subgroup or across sports.

References

1. Quarrie KL, Hopkins WG. Tackle injuries in professional Rugby Union. *Am J Sports Med* 2008;36(9):1705-16. doi: 10.1177/0363546508316768 [published Online First: 2008/05/23]
2. Fuller CW, Molloy MG, Bagate C, et al. Consensus statement on injury definitions and data collection procedures for studies of injuries in rugby union. *Br J Sports Med* 2007;41(5):328-31. doi: 10.1136/bjism.2006.033282
3. Fuller CW, Brooks JH, Cancea RJ, et al. Contact events in rugby union and their propensity to cause injury. *Br J Sports Med* 2007;41:862-67.

Daily Medical Report on Injuries and Illnesses

Country:

Date of report:

Form completed by: Name:

Contact details:

Please report: (1) All sport injuries and (2) all illnesses of your athletes newly incurred, recurrent or an exacerbation of an underlying stable injury/illness during the <name of the championship> regardless of the consequences with respect to absence from competition or training. The information provided will be treated strictly confidential.

1. Injury – Example reverse)

Definitions and codes (see

age 22	gender male / female	sport and event decathlon	date of injury 21. July	competition / training sprint competition	code 2	onset code 1	new code 4	
injury mechanism slipped and fell		code 5	injured body region ankle	code 17	injury type sprain	code 10	time-loss no / yes	duration 28 days

age	gender male / female	sport and event	date of injury	competition / training	code	onset code	new code	
injury mechanism		code	injured body region	code	injury type	code	time-loss no / yes	duration days

age	gender male / female	sport and event	date of injury	competition / training	code	onset code	new code	
injury mechanism		code	injured body region	code	injury type	code	time-loss no / yes	duration days

age	gender male / female	sport and event	date of injury	competition / training	code	onset code	new code	
injury mechanism		code	injured body region	code	injury type	code	time-loss no / yes	duration days

age	gender male / female	sport and event	date of injury	competition / training	code	onset code	new code	
injury mechanism		code	injured body region	code	injury type	code	time-loss no / yes	duration days

2. Illness – Example reverse)

Definitions and codes (see

age 27	gender male / female	sport and event athletics, pole vault	date of onset 24 th July	organ system / region respiratory system	code 13	
aetiology Environmental - not exercise related			code 3	new, recurrent or exacerbation code 1	time-loss no / yes	duration 2 days

age	gender male / female	sport and event	date of onset	organ system / region	code	
aetiology			code	new, recurrent or exacerbation code	time-loss no / yes	duration days

age	gender male / female	sport and event	date of onset	organ system / region	code	
aetiology			code	new , recurrent or exacerbation code	time-loss no / yes	duration days

age	gender male / female	sport and event	date of onset	organ system / region	code	
aetiology			code	new , recurrent or exacerbation code	time-loss no / yes	duration days

age	gender male / female	sport and event	date of onset	organ system / region	code	
aetiology			code	new , recurrent or exacerbation code	time-loss no / yes	duration days

☐ no new injury or illness in any athlete of our team today

If space is not sufficient to report all injuries or illnesses, please use additional forms.

Definitions and codes

For injuries (defined as tissue damage or other derangement of normal physical function due to participation in sports, resulting from rapid or repetitive transfer of kinetic energy)

Competition or training

1 competition, please specify event

2 training

3 peri-competition activities
(e.g. warm-up, cool-down)

Mode of onset

1 sudden after acute trauma

2 sudden but no acute trauma

3 gradual

4 mixed

Injury mechanism

1 no identifiable single event
(repetitive transfer of energy, overuse)

3 direct contact with another athlete

5 direct contact with an object (e.g. ball,
wall, ground, i.e. slipped and fell)

2 acute non-contact trauma

4 following contact with another
athlete (e.g. fall after a push)

6 following contact with an object

Injured body region

1 head / face

7 shoulder

13 hip / groin

2 neck / cervical spine

8 upper arm

14 thigh

3 chest (incl. chest organs)

9 elbow

15 knee

4 thoracic spine / upper back

10 forearm

16 lower leg / Achilles tendon

5 lumbar-sacral spine / buttock

11 wrist

17 ankle

6 abdomen (incl. abdominal organs)

12 hand

18 foot

Injury type

1 concussion / brain injury

10 joint sprain / ligament tear

19 contusion / bruise (superficial)

2 spinal cord injury

11 chronic instability

20 arthritis

3 peripheral nerve injury

12 tendon rupture

21 bursitis

4 bone fracture

13 tendinopathy

22 synovitis

5 bone stress injury

14 muscle strain / rupture / tear

23 vascular damage

6 bone contusion

15 muscle contusion

24 stump injury

7 avascular necrosis

16 muscle compartment syndrome

25 internal organ trauma

8 physis injury

17 laceration

26 unknown, or not specified

9 cartilage injury

18 abrasion

For illnesses (defined as a complaint or disorder not related to injury)

Organ system

1 cardiovascular

6 genitourinary

11 otological

2 dermatological

7 hematologic

12 psychiatric/psychological

3 dental

8 musculoskeletal

13 respiratory system

4 endocrinology

9 neurological

14 thermoregulatory system

5 gastrointestinal

10 ophthalmological

15 unknown, or not specified

Aetiology

1 allergic

5 infection

9 degenerative or chronic condition

2 environmental - exercise-related

6 neoplasm

10 developmental anomaly

3 environmental - non-exercise

7 metabolic/nutritional

11 drug-related/poisoning

4 immunological/inflammatory

8 thrombotic/haemorrhagic

12 unknown, or not specified

For injuries and illnesses

Sport and event

Please report the sport (e.g. athletics) *AND* specify the event (e.g. pole vault) if applicable.

New, recurrent or exacerbation

1 newly incurred during the championships

3 exacerbation of a stable (not recovered) condition

2 recurrent after full recovery and return-to-sport

4 unknown, or not specified

Time-loss in sport due to injury or illness

no athlete continues to train or compete, even if not at usual level (duration, intensity, performance)

yes athlete *did not finish* the training or competition when the injury occurred *OR* could not participate in sport later

Duration of impaired participation/ limited performance in sport due to injury or illness (in days)

Please provide an estimate of the number of days that the athlete will not be able to undertake his/her *normal training* or will not be able to *compete as usual*, counting the day *after* the onset of the injury/illness as day 1.

Medical Report of Injury or Illness

Date of report: _____

Team: _____ **Athlete identification:** _____ **Date of onset:** _____

For injury

Competition or training

- ☐ competition ☐ training ☐ peri-competition activities
(e.g. warm-up, cool-down)

Mode of onset

- ☐ sudden after acute trauma ☐ sudden but no acute trauma ☐ gradual ☐ mixed

Injury mechanism (each category might have subcategories based on the purpose of the surveillance)

- ☐ no identifiable single event ☐ direct contact with another athlete ☐ direct contact with an object
☐ non-contact trauma ☐ following contact with another athlete ☐ following contact with an object

Injured body region (each category might have subcategories based on the purpose of the surveillance)

- ☐ head ☐ shoulder ☐ hip / groin
☐ neck / cervical spine ☐ upper arm ☐ thigh
☐ chest (incl. chest organs) ☐ elbow ☐ knee
☐ thoracic spine / upper back ☐ forearm ☐ lower leg / Achilles tendon
☐ lumbar-sacral spine / buttock ☐ wrist ☐ ankle
☐ abdomen (incl. abdominal organs) ☐ hand ☐ foot

Injury type

- ☐ concussion / brain injury ☐ joint sprain / ligament tear ☐ contusion / bruise (superficial)
☐ spinal cord injury ☐ chronic instability ☐ arthritis
☐ peripheral nerve injury ☐ tendon rupture ☐ bursitis
☐ bone fracture ☐ tendinopathy ☐ synovitis
☐ bone stress injury ☐ muscle strain / rupture / tear ☐ vascular damage
☐ bone contusion ☐ muscle contusion ☐ stump injury
☐ avascular necrosis ☐ muscle compartment syndrome ☐ internal organ trauma
☐ physis injury ☐ laceration ☐ unknown, or not specified
☐ cartilage injury ☐ abrasion

For illness

Organ system

- ☐ cardiovascular ☐ genitourinary ☐ otological
☐ dermatological ☐ hematologic ☐ psychiatric / psychological
☐ dental ☐ musculoskeletal ☐ respiratory system
☐ endocrinology ☐ neurological ☐ thermoregulatory system
☐ gastrointestinal ☐ ophthalmological ☐ unknown, or not specified

Aetiology

- ☐ allergic ☐ infectious disease ☐ degenerative or chronic condition
☐ environmental - exercise-related ☐ neoplasm ☐ developmental anomaly
☐ environmental - non-exercise ☐ metabolic / nutritional ☐ drug-related / poisoning
☐ immunological / inflammatory ☐ vascular ☐ unknown, or not specified

For injury and illness

New, recurrent or exacerbation

- ☐ new ☐ recurrent after full recovery and return-to-sport ☐ unknown, or not specified
☐ exacerbation of a stable (not recovered) condition

Time-loss in sport due to injury / illness

- ☐ no ☐ yes

Date of full return to normal training and competition _____ (dd/mm/yy)

No return to sport possible: ☐ fatality ☐ permanent disability ☐ other reasons _____

Appendix 3: STROBE-SIIS (Sports Injury and Illness Surveillance) Statement 1.0—Checklist of items for the reporting of observational studies on injury and illness in sports

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract		
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	SIIS-1.1. Include information on the sport, athlete population (sex, age, geographic region) and level of competition. SIIS-1.2. Include the duration of observation (e.g. one season, one year, multiple years).	SIIS-1.1. ‘Study population characteristics’ SIIS-1.2. ‘Capturing and reporting athlete exposure’
		Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported		
Objectives	3	State specific objectives, including any pre-specified hypotheses	SIIS-3.1. State whether study was registered. Identify the registration number and database used.	SIIS-3.1. ‘Reporting guidelines—STROBE Sports Injury and Illness Surveillance (STROBE-SIIS)’
			SIIS-3.2. State the specific purpose of your study (e.g. to describe the injury burden associated with Olympic level rowing)	SIIS-3.2 Throughout consensus statement
Methods				
Study design	4	Present key elements of study design early in the paper	SIIS-4.1. Clearly specify which health problems are being observed.	SIIS-4.1. ‘Defining and classifying health problems’

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
			<p>SIIS-4.2. State explicitly which approach was used to record the health problem data, including all outcome measures or tools</p> <p>SIIS-4.3. State explicitly which coding system was used to classify the health problems (e.g. OSIICS, SMDCS, ICD, etc.)</p> <p>SIIS-4.4. Where relevant, clearly describe how athletes were categorised. Variables to consider could include the type of athlete and/or sport, the environment in which the sport occurs (e.g. type of course or playing area), the typical duration of the sport, the degree of physical contact permitted in the sport, and the equipment permitted.</p>	<p>SIIS-4.2. 'Data collection methods'</p> <p>SIIS-4.3. 'Classifying sports injury and illness diagnoses'</p> <p>SIIS-4.4. 'Study population characteristics'</p>
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	<p>SIIS-5.1. Describe the location, level of play, dates of observation and data collection methods (i.e. who, what, where).</p> <p>SIIS-5.2. Specify the dates of the surveillance period and how the data were handled when the study covered more than one season/calendar year.</p> <p>SIIS-5.3. Define whether the health problem data were collected prospectively or retrospectively.</p>	<p>SIIS-5.1. 'Study population characteristics'</p> <p>SIIS-5.2. 'Capturing and reporting athlete exposure'</p> <p>SIIS-5.3. 'Capturing and reporting athlete exposure' and 'Data collection methods'</p>

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
Participants	6	<p><i>(a) Cohort study</i>—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up</p> <p><i>Case-control study</i>—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls</p> <p><i>Cross-sectional study</i>—Give the eligibility criteria, and the sources and methods of selection of participants</p> <hr/> <p><i>(b) Cohort study</i>—For matched studies, give matching criteria and number of exposed and unexposed</p> <p><i>Case-control study</i>—For matched studies, give matching criteria and the number of controls per case</p>	SIIS-6.1. Define the population of athletes and how they were selected and recruited.	SIIS-6.1. ‘Data collection methods’ and ‘Study population characteristics’
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	<p>SIIS-7.1. Justify why you measured your primary and secondary outcomes of interest in the specific way chosen.</p> <p>SIIS-7.2. Describe the method for identifying your health problem outcome of interest.</p>	<p>SIIS-7.1. ‘Defining and classifying health problems’</p> <p>SIIS-7.2. ‘Defining and classifying health problems’</p>
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe	SIIS-8.1. Specify who collected/reported the data for the	SIIS-8.1. ‘Classifying sports injury and illness diagnoses’ and ‘Data collection methods’

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
		comparability of assessment methods if there is more than one group	<p>study and their qualifications (e.g. qualified doctor, data analyst, etc.).</p> <p>SIIS-8.2. Specify who coded the data for the study and their qualifications (e.g. qualified doctor, data analyst, etc.). In many instances, this will not be the same as SIIS-8.1.</p> <p>SIIS-8.3. Specify the direct methods used to collect the data, and the use of physical documents or an electronic tools. If extracting information from existing sources, specify the data source.</p> <p>SIIS-8.4. Specify the timing of and window for data collection (e.g. day health problem occurred or following day). Specify the frequency of data collection (e.g. daily, weekly, monthly).</p> <p>SIIS-8.5. Report the duration of surveillance (e.g. tournament, season, whole year, playing career).</p>	<p>SIIS-8.2. 'Classifying sports injury and illness diagnoses'</p> <p>SIIS-8.3. 'Data collection methods'</p> <p>SIIS-8.4. 'Relationship to sports activity' and 'Capturing and reporting athlete exposure'</p> <p>SIIS-8.5. 'Relationship to sports activity' and 'Capturing and reporting athlete exposure'</p>
Bias	9	Describe any efforts to address potential sources of bias	<p>SIIS-9.1. Clearly report any validation or reliability assessment of the data collection of tools.</p> <p>SIIS-9.2. Formally acknowledge any potential biases in associated with the data collection method (e.g. self-</p>	<p>SIIS-9.1. 'Data collection methods'</p> <p>SIIS-9.2. 'Data collection methods'</p>

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
			report, recall bias, reporting by non-medically trained staff, etc.)	
Study size	10	Explain how the study size was arrived at		
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	<p>SIIS-11.1 Explain in detail how multiple injuries/illness episodes are handled both in individual athletes and across athletes/surveillance periods.</p> <p>SIIS-11.2. Specify how injury severity was calculated.</p>	<p>SIIS-11.1. 'Multiple events and health problems' and 'Subsequent, recurrent and/or exacerbation of health problems'</p> <p>SIIS-11.2. 'Severity of health problems'</p>
Statistical methods	12	<p>(a) Describe all statistical methods, including those used to control for confounding</p> <p>(b) Describe any methods used to examine subgroups and interactions</p> <p>(c) Explain how missing data were addressed</p>	<p>SIIS-12.1. Specify how exposure to risk has been adjusted for and specify the units (e.g. per participant, per athlete exposure, etc.).</p> <p>SIIS-12.2 Specify how relevant risk measures (incidence, prevalence, etc.) were calculated.</p> <p>SIIS-12.3. When relevant to the study aim, specify how injury burden was calculated and analysed.</p>	<p>SIIS-12.1. 'Capturing and reporting athlete exposure'</p> <p>SIIS-12.2 'Expressing risk'</p> <p>SIIS-12.3. 'Burden of health problems'</p> <p>SIIS-12.4. 'Multiple health problems' and 'Subsequent, recurrent and/or exacerbation of injury/illness'</p> <p>SIIS-12.5. 'Capturing and reporting athlete exposure'</p>

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
			subsequent return to play and re-injuries, or modelling of all injuries). SIIS-12.5. Explain how/if athletes not included at outset (e.g. those already injured) were handled in the analyses.	
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	SIIS-12.6. In longitudinal studies, it is particularly important to explain how athlete follow-up has been managed. For example, what happened if a player was transferred to another team or has been censored (for those no longer part of the study due to removal during the observation period). Censoring can occur when athletes are removed due to transfer out of the team/study, injury/illness or due to study design.	SIIS-12.6. ‘Capturing and reporting athlete exposure’
		(e) Describe any sensitivity analyses		
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—e.g. numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	SIIS-13.1. Clearly state the number of athletes followed-up, the number (and %) of those with the health problem and the number of problems reported among them (a median number of problems per affected athlete could be useful). SIIS-13.2. For studies over multiple seasons/years, report the total	SIIS-13.1. ‘Multiple health problems’ SIIS-13.2. ‘Multiple health problems’ and Expressing risk’

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
			numbers of health problems for each year and numbers common to each period.	
		(b) Give reasons for non-participation at each stage	SIIS-13.3. Report how athletes removed (e.g. due to transfer of teams or time-out due to injury or illness) impact upon data at key data collection/reporting points, ideally with a flow diagram	SIIS-13.3. Throughout consensus statement
Descriptive data	14*	(a) Give characteristics of study participants (e.g. demographic, clinical, social) and information on exposures and potential confounders	SIIS-14.1. Include detail on the level of competition being observed (e.g. by age levels, skill level, sex, etc.).	SIIS-14.1. 'Study population characteristics'
		(b) Indicate number of participants with missing data for each variable of interest		
		(c) <i>Cohort study</i> —Summarise follow-up time (e.g. average and total amount)		
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	SIIS-15.1. In many observational studies, individuals will sustain more than one health problem over the surveillance period. Take care to ensure descriptive data representing both the number of health problems and the number of athletes affected. It is important to represent effectively both the analysis and reporting of correct units for frequency data, i.e. the % of affected	SIIS-15.1. 'Multiple health problems' and 'Subsequent, recurrent and/or exacerbation of injury/illness'

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
			athletes or the % of injuries, body regions, etc.	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure		
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures		
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g. 95% confidence interval). Make clear which confounders were adjusted for and why they were included	SIIS-16.1. Report exposure-adjusted incidence or prevalence measures with appropriate confidence intervals when presenting risk measures. SIIS-16.2. Report details of interest, such as mode of onset	SIIS-16.1. ‘Expressing risk’ SIIS-16.2. ‘Relationship to sports activity’, ‘Mode of onset—injury’, ‘Mode of onset—illness’ and ‘Classifying the mechanism of injury’
		(b) Report category boundaries when continuous variables were categorized		
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period		
Other analyses	17	Report other analyses done—e.g. analyses of subgroups and interactions, and sensitivity analyses	SIIS-17.1 Report injury diagnosis information, including region and tissue type in tabular form.	SIIS-17.1. ‘Defining and classifying health problems’
Discussion				
Key results	18	Summarise key results with reference to study objectives		
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or	SIIS-19.1. Discuss limitations in the data collection and coding procedures adopted, including in	SIIS 19.1. ‘Data collection methods’ and ‘Expressing risk’

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
		imprecision. Discuss both direction and magnitude of any potential bias	relation to any risk measures calculated.	
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence		
Generalisability	21	Discuss the generalisability (external validity) of the study results	SIIS-21.1. Discuss the generalizability of the athlete study population, and health problem sub-groups of interest, to broader athlete groups.	SIIS-21.2. 'Relationship to sports activity' and 'Study population characteristics'
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based		
Ethics	23		SIIS-23.1. Outline how individual athlete data privacy and confidentiality considerations were addressed, in line with the Declaration of Helsinki.	SIIS-23.1. 'Research ethics and data security'

Note: The STROBE-SIIS checklist with additional sports epidemiology annotations should be used in conjunction with the original STROBE guideline (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

⁺For brevity, the phrase health problem is used here to encompass both injury and illness.

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

^^ Where there is a blank cell in this column, there are no specific additional reporting requirements for sports injury and illness surveillance over what is already covered in the original STROBE checklist.

Reference

1. Orchard O, Meeuwisse W, Derman W, et al. Refinement and presentation of the Calgary Sport Medicine Diagnostic Coding System (SMDSC) and the Orchard Sport Injury & Illness Classification System (OSIICS). *Br J Sports Med* In preparation

Appendix 1: Case study: Tackle injuries to ball carriers in rugby

The data set

A study was conducted in which video records of every tackle that occurred in 434 professional rugby matches was coded on a range of dimensions, including the location on the body at which the tackler(s) contacted the ball carrier ('tackle height').¹ The information in the table has been restricted to that from 43 366 tackles in which a single tackler tackled a ball carrier (i.e. the 100 tackle events per match that met this criteria). For the purposes of the example below, an injury is defined as 'any injury sustained by a ball carrier during a rugby tackle that required them to be removed from the field of play for the remainder of the match'.

Different denominators: different perspectives on risk

Rates of injury have been presented in Table 1 as 'per 10 000 tackles' and 'per 10 000 player-hours'. If data were reported using only the time-based denominator, as has been the case in most studies of sports injury epidemiology, the conclusion drawn would be that 'high' and 'middle' tackles are those that carry the greatest risk to ball carriers. When the relative frequency of the tackles is considered, and the rates are presented on a 'per 10 000 tackles' basis, head/neck tackles place ball carriers at the greatest risk of injury *when they occur*.

Table 1 Injury rates to ball carriers in rugby tackles, expressed via event-based and time-based denominators.

Injuries requiring the player to be removed from the match				
Tackle height	Tackles per match	Per 10 000 tackles	Per 10 000 player-hours	Percent of injuries per 10 000 player hours
Head/neck	4 ± 2	43 (23 to 79)	4 (2 to 8)	13 (7 to 23)
High	37 ± 10	12 (8 to 17)	11 (8 to 16)	36 (26 to 47)
Middle	44 ± 9	9 (6 to 13)	10 (7 to 15)	32 (23 to 43)
Low	15 ± 5	16 (9 to 26)	6 (3 to 10)	19 (12 to 29)

The different perspectives provided by 'per-event' and 'per-time' denominators can be helpful in identifying injury prevention priorities. If the overall risk of injuries was considered 'unacceptably high' by those responsible for managing the risks in the sport, then reducing the numbers of the most

common tackles in the game would have the greatest effect; together ‘high’ and ‘middle’ tackles account for over two-thirds of all tackle injuries requiring ball carriers to be removed from the pitch. Reducing the numbers of such tackles, or the characteristics of them, would probably require major changes to the sport of rugby. If, however, the overall degree of risk was considered ‘acceptable’, then focussing on decreasing the number of ‘head and neck’ tackles would have a modest effect on overall injury rates, but reduce the occurrence of a particularly risky element of the sport (note: head/neck tackles are not permitted within the laws of rugby, but sometimes occur).

The type of exposure measures that can form the basis of risk statistics is presented in Table 2, along with a range of the risk measures that have been reported in studies of team sports injury epidemiology. The examples are taken from the same study discussed above.

Table 2 A range of exposure and risk statistics derived from injury surveillance data - examples from a study of rugby tackle injuries.¹

Statistic	Value	Calculation	Explanation	Comment
Injury statistics				
Number of injuries (carrier injury replacements in 434 matches)	53	Nil	Count of the number of tackler injuries requiring the injured player to be replaced observed in 434 matches.	The ‘numerator’ used for calculating the rate of tackler replacement injuries per unit of time or per tackle. Absolute numbers and costs of injuries <i>are</i> of interest to risk managers, especially when provided in parallel with rates
Number of injured players (some were injured more than once)	48	Nil		The numerator for calculating ‘injury risk’
Exposure measures				
Player hours in 434 matches	17 360	30*579	Thirty players (15 from each team) multiplied by 579 (hours of play in 434 matches of 80 minutes duration)	This number provides a ‘time-window’ denominator. Usually it is assumed that time lost for yellow and red cards, or time gained for ‘extra time’ is negligible and is ignored.
Number of single tackler tackle events in 434 matches	43 366	Nil	All tackles in 434 matches were coded, regardless of whether they resulted in injury	This number forms an ‘event-based’ denominator.

Statistic	Value	Calculation	Explanation	Comment
Number of players who appeared in the 434 matches	1403	Nil		This is a count of the size of the cohort across the entire study period; it is used as the denominator for calculating 'injury risk'.
Number of full player matches	13 020	30*434	Thirty players (15 from each team) multiplied by 434 matches	This number provides a 'per-match' denominator.
Number of athlete-exposures (athlete-participations)	17 685	Nil	Count of the number of players who took the field over 434 matches (players can be substituted for tactical purposes or replaced due to injury)	The similarity to the number of player hours is coincidental; there are 40 hours of player-time per match, and the average number of athlete exposures per match over this series of matches was 40.8.
Risk measures				
Period prevalence (percentage of cohort injured)	3%	$(48/1403)*100$	Percentage of people who appeared in matches who were replaced	Often reported as 'risk per season' or 'risk per year'. Can't be easily used to compare between activities if the duration of surveillance varies from activity to activity. The longer the surveillance period, the higher the risk will appear to be for closed cohorts
Injuries per 1 000 player-hours	3.1	$(53/17\ 360)*1\ 000$	The number of injuries is divided by the number of hours of player exposure, and multiplied by a scaling factor (e.g. 1 000, 10 000) to provide a rate that is convenient to work with (e.g. numbers in the range of 1	The most commonly reported metric of injury rates in studies of rugby injury epidemiology has been rate of injuries per 1 000 player-hours. This convention is endorsed in the consensus document by Fuller et al. ²

Statistic	Value	Calculation	Explanation	Comment
			to 1 000 rather than numbers less than zero or greater than 1 000	It is relatively simple to estimate based on the number of matches played. Comparisons of incidence rates between activities or within activities over time based on this denominator require the assumption that the number and characteristics of energy transfers to which participants are exposed remains relatively constant per unit of exposure time.
Injuries per 1 000 matches	122	$(53/434)*1\ 000$	Rate of tackler replacements per rugby union match multiplied by 1 000. The rate per match is multiplied by a factor that provides a convenient interpretation; 0.12 carrier replacement injuries per match; 12.2 per 100 matches, 122 per 1 000 matches etc.	Ignores number of players and match duration, and provides an estimate of the number of injuries an observer would expect to see if they watched 1 000 matches. Not useful for comparing incidence rates between activities of differing durations or numbers of participants.
Injuries per 1 000 hours of play (ignoring number of players)	92	$(53/579)*1\ 000$	The rate per hour is multiplied by a factor that provides a convenient interpretation; 0.9 carrier replacement injuries per hour; 9.2 per 100 hours, 92 per 1 000 hours etc.	Ignores number of players, and provides an estimate of the number of injuries an observer would expect to see if they watched 1 000 hours of play. Not useful for comparing between activities with differing numbers of participants (because the sizes of the populations at risk differ)
Injuries per 1 000 athlete-exposures	3.0	$(53/17685)*1\ 000$	Carrier injury replacements per 1 000 athlete exposures	Injuries per 1 000 athlete exposures are commonly reported in injury surveillance in the United States. Problematic for comparing between activities that

Statistic	Value	Calculation	Explanation	Comment
(athlete-participations)				have different numbers of typical athlete exposures per match, or when the average exposure time per player changes over time.
Injuries per 1 000 full player matches	4.1	$(53/13020)*1\ 000$		Not commonly used. It ignores the duration of the match, and as such has similar drawbacks to reporting injuries per athlete exposure, because the time-window of exposure varies between activities of different durations.
Injuries per 1 000 'ball in play' player-hours	6.8	$(53/7740)*1\ 000$		Not commonly used, but technically a more accurate measure of exposure than injuries per 1 000 player-hours, because players are only exposed to tackles when the ball is 'in play'.
Injuries per 1 000 'ball in play and ball-carrier's team in possession' player-hours	13.5	$(53/3819)*1\ 000$		Again, not commonly used, but an even closer approximation of actual time exposed to the risk of ball carrier injuries. Players are only tackled when the ball is in play and their team is in possession.
Injuries per 1 000 tackle events	1.2	$(53/43366)*1\ 000$	Ball-carrier injury replacements per 1 000 times tackled	Provides an accurate assessment of per-event injury rates, but in isolation ignores frequency of occurrence of the event of interest. Injury rates per event have been sometimes been termed 'injury propensity'. ³

Statistic	Value	Calculation	Explanation	Comment
Injuries per 1 000 players per year	24	(23+17+13)*1 000/ (983+589+627)		Sometimes provided as a gross estimate of injury risk when participant numbers and injury numbers are available, but no measure of exposure for players is available (e.g. data derived from insurance claims combined with registers of participants). Of limited use when exposure varies by subgroup or across sports.

References

1. Quarrie KL, Hopkins WG. Tackle injuries in professional Rugby Union. *Am J Sports Med* 2008;36(9):1705-16. doi: 10.1177/0363546508316768 [published Online First: 2008/05/23]
2. Fuller CW, Molloy MG, Bagate C, et al. Consensus statement on injury definitions and data collection procedures for studies of injuries in rugby union. *Br J Sports Med* 2007;41(5):328-31. doi: 10.1136/bjsm.2006.033282
3. Fuller CW, Brooks JH, Cancea RJ, et al. Contact events in rugby union and their propensity to cause injury. *Br J Sports Med* 2007;41:862-67.

Daily Medical Report on Injuries and Illnesses

Country:

Date of report:

Form completed by: Name:

Contact details:

Please report: (1) All sport injuries and (2) all illnesses of your athletes newly incurred, recurrent or an exacerbation of an underlying stable injury/illness during the <name of the championship> regardless of the consequences with respect to absence from competition or training. The information provided will be treated strictly confidential.

1. Injury – Example reverse)

Definitions and codes (see

age 22	gender male / female	sport and event decathlon	date of injury 21. July	competition / training sprint competition	code 2	onset code 1	new code 4		
injury mechanism slipped and fell		code 5	injured body region ankle	code 17	injury type sprain		code 10	time-loss no / yes	duration 28 days

age	gender male / female	sport and event	date of injury	competition / training	code	onset code	new code		
injury mechanism		code	injured body region	code	injury type		code	time-loss no / yes	duration days

age	gender male / female	sport and event	date of injury	competition / training	code	onset code	new code		
injury mechanism		code	injured body region	code	injury type		code	time-loss no / yes	duration days

age	gender male / female	sport and event	date of injury	competition / training	code	onset code	new code		
injury mechanism		code	injured body region	code	injury type		code	time-loss no / yes	duration days

age	gender male / female	sport and event	date of injury	competition / training	code	onset code	new code		
injury mechanism		code	injured body region	code	injury type		code	time-loss no / yes	duration days

age	gender male / female	sport and event	date of injury	competition / training	code	onset code	new code		
injury mechanism		code	injured body region	code	injury type		code	time-loss no / yes	duration days

2. Illness – Example reverse)

Definitions and codes (see

age 27	gender male / female	sport and event athletics, pole vault	date of onset 24 th July	organ system / region respiratory system		code 13	
aetiology Environmental - not exercise related			code 3	new, recurrent or exacerbation code 1		time-loss no / yes	duration 2 days

age	gender male / female	sport and event	date of onset	organ system / region		code	
aetiology			code	new, recurrent or exacerbation code		time-loss no / yes	duration days

age	gender male / female	sport and event	date of onset	organ system / region		code	
aetiology			code	new , recurrent or exacerbation code		time-loss no / yes	duration days

age	gender male / female	sport and event	date of onset	organ system / region		code	
aetiology			code	new , recurrent or exacerbation code		time-loss no / yes	duration days

age	gender male / female	sport and event	date of onset	organ system / region		code	
aetiology			code	new , recurrent or exacerbation code		time-loss no / yes	duration days

☐ no new injury or illness in any athlete of our team today

If space is not sufficient to report all injuries or illnesses, please use additional forms.

Definitions and codes

For injuries (defined as tissue damage or other derangement of normal physical function due to participation in sports, resulting from rapid or repetitive transfer of kinetic energy)

Competition or training

1 competition, please specify event

2 training

3 peri-competition activities
(e.g. warm-up, cool-down)

Mode of onset

1 sudden after acute trauma

2 sudden but no acute trauma

3 gradual

4 mixed

Injury mechanism

1 no identifiable single event
(repetitive transfer of energy, overuse)

3 direct contact with another athlete

5 direct contact with an object (e.g. ball, wall, ground, i.e. slipped and fell)

2 acute non-contact trauma

4 following contact with another athlete (e.g. fall after a push)

6 following contact with an object

Injured body region

1 head / face

7 shoulder

13 hip / groin

2 neck / cervical spine

8 upper arm

14 thigh

3 chest (incl. chest organs)

9 elbow

15 knee

4 thoracic spine / upper back

10 forearm

16 lower leg / Achilles tendon

5 lumbar-sacral spine / buttock

11 wrist

17 ankle

6 abdomen (incl. abdominal organs)

12 hand

18 foot

Injury type

1 concussion / brain injury

10 joint sprain / ligament tear

19 contusion / bruise (superficial)

2 spinal cord injury

11 chronic instability

20 arthritis

3 peripheral nerve injury

12 tendon rupture

21 bursitis

4 bone fracture

13 tendinopathy

22 synovitis

5 bone stress injury

14 muscle strain / rupture / tear

23 vascular damage

6 bone contusion

15 muscle contusion

24 stump injury

7 avascular necrosis

16 muscle compartment syndrome

25 internal organ trauma

8 physis injury

17 laceration

26 unknown, or not specified

9 cartilage injury

18 abrasion

For illnesses (defined as a complaint or disorder not related to injury)

Organ system

1 cardiovascular

6 genitourinary

11 otological

2 dermatological

7 hematologic

12 psychiatric/psychological

3 dental

8 musculoskeletal

13 respiratory system

4 endocrinology

9 neurological

14 thermoregulatory system

5 gastrointestinal

10 ophthalmological

15 unknown, or not specified

Aetiology

1 allergic

5 infection

9 degenerative or chronic condition

2 environmental - exercise-related

6 neoplasm

10 developmental anomaly

3 environmental - non-exercise

7 metabolic/nutritional

11 drug-related/poisoning

4 immunological/inflammatory

8 thrombotic/haemorrhagic

12 unknown, or not specified

For injuries and illnesses

Sport and event

Please report the sport (e.g. athletics) *AND* specify the event (e.g. pole vault) if applicable.

New, recurrent or exacerbation

1 newly incurred during the championships

3 exacerbation of a stable (not recovered) condition

2 recurrent after full recovery and return-to-sport

4 unknown, or not specified

Time-loss in sport due to injury or illness

no athlete continues to train or compete, even if not at usual level (duration, intensity, performance)

yes athlete *did not finish* the training or competition when the injury occurred *OR* could not participate in sport later

Duration of impaired participation/ limited performance in sport due to injury or illness (in days)

Please provide an estimate of the number of days that the athlete will not be able to undertake his/her *normal training* or will not be able to *compete as usual*, counting the day *after* the onset of the injury/illness as day 1.

Medical Report of Injury or Illness

Date of report: _____

Team: _____ **Athlete identification:** _____ **Date of onset:** _____

For injury

Competition or training

- ☐ competition ☐ training ☐ peri-competition activities
(e.g. warm-up, cool-down)

Mode of onset

- ☐ sudden after acute trauma ☐ sudden but no acute trauma ☐ gradual ☐ mixed

Injury mechanism (each category might have subcategories based on the purpose of the surveillance)

- ☐ no identifiable single event ☐ direct contact with another athlete ☐ direct contact with an object
☐ non-contact trauma ☐ following contact with another athlete ☐ following contact with an object

Injured body region (each category might have subcategories based on the purpose of the surveillance)

- ☐ head ☐ shoulder ☐ hip / groin
☐ neck / cervical spine ☐ upper arm ☐ thigh
☐ chest (incl. chest organs) ☐ elbow ☐ knee
☐ thoracic spine / upper back ☐ forearm ☐ lower leg / Achilles tendon
☐ lumbar-sacral spine / buttock ☐ wrist ☐ ankle
☐ abdomen (incl. abdominal organs) ☐ hand ☐ foot

Injury type

- ☐ concussion / brain injury ☐ joint sprain / ligament tear ☐ contusion / bruise (superficial)
☐ spinal cord injury ☐ chronic instability ☐ arthritis
☐ peripheral nerve injury ☐ tendon rupture ☐ bursitis
☐ bone fracture ☐ tendinopathy ☐ synovitis
☐ bone stress injury ☐ muscle strain / rupture / tear ☐ vascular damage
☐ bone contusion ☐ muscle contusion ☐ stump injury
☐ avascular necrosis ☐ muscle compartment syndrome ☐ internal organ trauma
☐ physis injury ☐ laceration ☐ unknown, or not specified
☐ cartilage injury ☐ abrasion

For illness

Organ system

- ☐ cardiovascular ☐ genitourinary ☐ otological
☐ dermatological ☐ hematologic ☐ psychiatric / psychological
☐ dental ☐ musculoskeletal ☐ respiratory system
☐ endocrinology ☐ neurological ☐ thermoregulatory system
☐ gastrointestinal ☐ ophthalmological ☐ unknown, or not specified

Aetiology

- ☐ allergic ☐ infectious disease ☐ degenerative or chronic condition
☐ environmental - exercise-related ☐ neoplasm ☐ developmental anomaly
☐ environmental - non-exercise ☐ metabolic / nutritional ☐ drug-related / poisoning
☐ immunological / inflammatory ☐ vascular ☐ unknown, or not specified

For injury and illness

New, recurrent or exacerbation

- ☐ new ☐ recurrent after full recovery and return-to-sport ☐ unknown, or not specified
☐ exacerbation of a stable (not recovered) condition

Time-loss in sport due to injury / illness

- ☐ no ☐ yes

Date of full return to normal training and competition _____ (dd/mm/yy)

No return to sport possible: ☐ fatality ☐ permanent disability ☐ other reasons _____

Appendix 3: STROBE-SIIS (Sports Injury and Illness Surveillance) Statement 1.0—Checklist of items for the reporting of observational studies on injury and illness in sports

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract		
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	SIIS-1.1. Include information on the sport, athlete population (sex, age, geographic region) and level of competition. SIIS-1.2. Include the duration of observation (e.g. one season, one year, multiple years).	SIIS-1.1. ‘Study population characteristics’ SIIS-1.2. ‘Capturing and reporting athlete exposure’
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported		
Objectives	3	State specific objectives, including any pre-specified hypotheses	SIIS-3.1. State whether study was registered. Identify the registration number and database used.	SIIS-3.1. ‘Reporting guidelines—STROBE Sports Injury and Illness Surveillance (STROBE-SIIS)’
			SIIS-3.2. State the specific purpose of your study (e.g. to describe the injury burden associated with Olympic level rowing)	SIIS-3.2 Throughout consensus statement
Methods				
Study design	4	Present key elements of study design early in the paper	SIIS-4.1. Clearly specify which health problems are being observed.	SIIS-4.1. ‘Defining and classifying health problems’

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
			<p>SIIS-4.2. State explicitly which approach was used to record the health problem data, including all outcome measures or tools</p> <p>SIIS-4.3. State explicitly which coding system was used to classify the health problems (e.g. OSIICS, SMDCS, ICD, etc.)</p> <p>SIIS-4.4. Where relevant, clearly describe how athletes were categorised. Variables to consider could include the type of athlete and/or sport, the environment in which the sport occurs (e.g. type of course or playing area), the typical duration of the sport, the degree of physical contact permitted in the sport, and the equipment permitted.</p>	<p>SIIS-4.2. 'Data collection methods'</p> <p>SIIS-4.3. 'Classifying sports injury and illness diagnoses'</p> <p>SIIS-4.4. 'Study population characteristics'</p>
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	<p>SIIS-5.1. Describe the location, level of play, dates of observation and data collection methods (i.e. who, what, where).</p> <p>SIIS-5.2. Specify the dates of the surveillance period and how the data were handled when the study covered more than one season/calendar year.</p> <p>SIIS-5.3. Define whether the health problem data were collected prospectively or retrospectively.</p>	<p>SIIS-5.1. 'Study population characteristics'</p> <p>SIIS-5.2. 'Capturing and reporting athlete exposure'</p> <p>SIIS-5.3. 'Capturing and reporting athlete exposure' and 'Data collection methods'</p>

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
Participants	6	<p><i>(a) Cohort study</i>—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up</p> <p><i>Case-control study</i>—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls</p> <p><i>Cross-sectional study</i>—Give the eligibility criteria, and the sources and methods of selection of participants</p> <hr/> <p><i>(b) Cohort study</i>—For matched studies, give matching criteria and number of exposed and unexposed</p> <p><i>Case-control study</i>—For matched studies, give matching criteria and the number of controls per case</p>	SIIS-6.1. Define the population of athletes and how they were selected and recruited.	SIIS-6.1. ‘Data collection methods’ and ‘Study population characteristics’
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	<p>SIIS-7.1. Justify why you measured your primary and secondary outcomes of interest in the specific way chosen.</p> <p>SIIS-7.2. Describe the method for identifying your health problem outcome of interest.</p>	<p>SIIS-7.1. ‘Defining and classifying health problems’</p> <p>SIIS-7.2. ‘Defining and classifying health problems’</p>
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe	SIIS-8.1. Specify who collected/reported the data for the	SIIS-8.1. ‘Classifying sports injury and illness diagnoses’ and ‘Data collection methods’

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
		comparability of assessment methods if there is more than one group	<p>study and their qualifications (e.g. qualified doctor, data analyst, etc.).</p> <p>SIIS-8.2. Specify who coded the data for the study and their qualifications (e.g. qualified doctor, data analyst, etc.). In many instances, this will not be the same as SIIS-8.1.</p> <p>SIIS-8.3. Specify the direct methods used to collect the data, and the use of physical documents or an electronic tools. If extracting information from existing sources, specify the data source.</p> <p>SIIS-8.4. Specify the timing of and window for data collection (e.g. day health problem occurred or following day). Specify the frequency of data collection (e.g. daily, weekly, monthly).</p> <p>SIIS-8.5. Report the duration of surveillance (e.g. tournament, season, whole year, playing career).</p>	<p>SIIS-8.2. ‘Classifying sports injury and illness diagnoses’</p> <p>SIIS-8.3. ‘Data collection methods’</p> <p>SIIS-8.4. ‘Relationship to sports activity’ and ‘Capturing and reporting athlete exposure’</p> <p>SIIS-8.5. ‘Relationship to sports activity’ and ‘Capturing and reporting athlete exposure’</p>
Bias	9	Describe any efforts to address potential sources of bias	<p>SIIS-9.1. Clearly report any validation or reliability assessment of the data collection of tools.</p> <p>SIIS-9.2. Formally acknowledge any potential biases in associated with the data collection method (e.g. self-</p>	<p>SIIS-9.1. ‘Data collection methods’</p> <p>SIIS-9.2. ‘Data collection methods’</p>

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
			report, recall bias, reporting by non-medically trained staff, etc.)	
Study size	10	Explain how the study size was arrived at		
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	<p>SIIS-11.1 Explain in detail how multiple injuries/illness episodes are handled both in individual athletes and across athletes/surveillance periods.</p> <p>SIIS-11.2. Specify how injury severity was calculated.</p>	<p>SIIS-11.1. 'Multiple events and health problems' and 'Subsequent, recurrent and/or exacerbation of health problems'</p> <p>SIIS-11.2. 'Severity of health problems'</p>
Statistical methods	12	<p>(a) Describe all statistical methods, including those used to control for confounding</p> <p>(b) Describe any methods used to examine subgroups and interactions</p> <p>(c) Explain how missing data were addressed</p>	<p>SIIS-12.1. Specify how exposure to risk has been adjusted for and specify the units (e.g. per participant, per athlete exposure, etc.).</p> <p>SIIS-12.2 Specify how relevant risk measures (incidence, prevalence, etc.) were calculated.</p> <p>SIIS-12.3. When relevant to the study aim, specify how injury burden was calculated and analysed.</p>	<p>SIIS-12.1. 'Capturing and reporting athlete exposure'</p> <p>SIIS-12.2 'Expressing risk'</p> <p>SIIS-12.3. 'Burden of health problems'</p> <p>SIIS-12.4. 'Multiple health problems' and 'Subsequent, recurrent and/or exacerbation of injury/illness'</p> <p>SIIS-12.5. 'Capturing and reporting athlete exposure'</p>

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
			subsequent return to play and re-injuries, or modelling of all injuries). SIIS-12.5. Explain how/if athletes not included at outset (e.g. those already injured) were handled in the analyses.	
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	SIIS-12.6. In longitudinal studies, it is particularly important to explain how athlete follow-up has been managed. For example, what happened if a player was transferred to another team or has been censored (for those no longer part of the study due to removal during the observation period). Censoring can occur when athletes are removed due to transfer out of the team/study, injury/illness or due to study design.	SIIS-12.6. ‘Capturing and reporting athlete exposure’
		(e) Describe any sensitivity analyses		
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—e.g. numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	SIIS-13.1. Clearly state the number of athletes followed-up, the number (and %) of those with the health problem and the number of problems reported among them (a median number of problems per affected athlete could be useful). SIIS-13.2. For studies over multiple seasons/years, report the total	SIIS-13.1. ‘Multiple health problems’ SIIS-13.2. ‘Multiple health problems’ and Expressing risk’

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
			numbers of health problems for each year and numbers common to each period.	
		(b) Give reasons for non-participation at each stage	SIIS-13.3. Report how athletes removed (e.g. due to transfer of teams or time-out due to injury or illness) impact upon data at key data collection/reporting points, ideally with a flow diagram	SIIS-13.3. Throughout consensus statement
Descriptive data	14*	(a) Give characteristics of study participants (e.g. demographic, clinical, social) and information on exposures and potential confounders	SIIS-14.1. Include detail on the level of competition being observed (e.g. by age levels, skill level, sex, etc.).	SIIS-14.1. 'Study population characteristics'
		(b) Indicate number of participants with missing data for each variable of interest		
		(c) <i>Cohort study</i> —Summarise follow-up time (e.g. average and total amount)		
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	SIIS-15.1. In many observational studies, individuals will sustain more than one health problem over the surveillance period. Take care to ensure descriptive data representing both the number of health problems and the number of athletes affected. It is important to represent effectively both the analysis and reporting of correct units for frequency data, i.e. the % of affected	SIIS-15.1. 'Multiple health problems' and 'Subsequent, recurrent and/or exacerbation of injury/illness'

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
			athletes or the % of injuries, body regions, etc.	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure		
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures		
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g. 95% confidence interval). Make clear which confounders were adjusted for and why they were included	SIIS-16.1. Report exposure-adjusted incidence or prevalence measures with appropriate confidence intervals when presenting risk measures. SIIS-16.2. Report details of interest, such as mode of onset	SIIS-16.1. ‘Expressing risk’ SIIS-16.2. ‘Relationship to sports activity’, ‘Mode of onset—injury’, ‘Mode of onset—illness’ and ‘Classifying the mechanism of injury’
		(b) Report category boundaries when continuous variables were categorized		
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period		
Other analyses	17	Report other analyses done—e.g. analyses of subgroups and interactions, and sensitivity analyses	SIIS-17.1 Report injury diagnosis information, including region and tissue type in tabular form.	SIIS-17.1. ‘Defining and classifying health problems’
Discussion				
Key results	18	Summarise key results with reference to study objectives		
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or	SIIS-19.1. Discuss limitations in the data collection and coding procedures adopted, including in	SIIS 19.1. ‘Data collection methods’ and ‘Expressing risk’

Item	Item No	Recommendation from the STROBE Statement	STROBE-SIIS Extension +	Source of rationale for item from the consensus statement and where to find further details
		imprecision. Discuss both direction and magnitude of any potential bias	relation to any risk measures calculated.	
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence		
Generalisability	21	Discuss the generalisability (external validity) of the study results	SIIS-21.1. Discuss the generalizability of the athlete study population, and health problem sub-groups of interest, to broader athlete groups.	SIIS-21.2. 'Relationship to sports activity' and 'Study population characteristics'
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based		
Ethics	23		SIIS-23.1. Outline how individual athlete data privacy and confidentiality considerations were addressed, in line with the Declaration of Helsinki.	SIIS-23.1. 'Research ethics and data security'

Note: The STROBE-SIIS checklist with additional sports epidemiology annotations should be used in conjunction with the original STROBE guideline (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

⁺For brevity, the phrase health problem is used here to encompass both injury and illness.

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

^^ Where there is a blank cell in this column, there are no specific additional reporting requirements for sports injury and illness surveillance over what is already covered in the original STROBE checklist.

Reference

1. Orchard O, Meeuwisse W, Derman W, et al. Refinement and presentation of the Calgary Sport Medicine Diagnostic Coding System (SMDSC) and the Orchard Sport Injury & Illness Classification System (OSIICS). *Br J Sports Med* In preparation