Methods for epidemiological studies in competitive cycling: an extension of the IOC consensus statement on methods for recording and reporting of epidemiological data on injury and illness in sport 2020

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Abstract

In 2020, the IOC released a consensus statement that provides overall guidelines for the recording and reporting of epidemiological data on injury and illness in sport. Some aspects of this statement need to be further specified on a sport-by-sport basis. To extend the IOC consensus statement on methods for recording and reporting of epidemiological data on injury and illness in sports and to meet the sport-specific requirements of all cycling disciplines regulated by the Union Cycliste Internationale (UCI). A panel of 20 experts, all with experience in cycling or cycling medicine, participated in the drafting of this cycling-specific extension of the IOC consensus statement. In preparation, panel members were sent the IOC consensus statement, the first draft of this manuscript and a list of topics to be discussed. The expert panel met in July 2020 for a 1-day video conference to discuss the manuscript and specific topics. The final manuscript was developed in an iterative process involving all panel members. This paper extends the IOC consensus statement to provide cycling-specific recommendations on health problem definitions, mode of onset, injury mechanisms and circumstances, diagnosis classifications, exposure, study population characteristics and data collection methods. Recommendations apply to all UCI cycling disciplines, for both able-bodied cyclists and para-cyclists. The recommendations presented in this consensus statement will improve the consistency and accuracy of future epidemiological studies of injury and illness in cycling.

Introduction

Millions of people around the world ride bicycles for transport, enjoyment and exercise. Cycling also has a long history as a competitive sport, having been part of every modern Olympic Games since their inception in 1896. Today, there are many different disciplines of competitive cycling. The sport's governing body, the Union Cycliste Internationale (UCI), currently administers the following disciplines: road cycling, mountain biking, cyclo-cross, track cycling, bicycle motocross (BMX) racing, BMX freestyle, trials, indoor cycling (artistic cycling and cycle ball) and para-cycling.[1]

Strong evidence links cycling with a broad spectrum of health benefits and supports the promotion of cycling as an effective public health initiative.[2 3] However, as for any other sport, participation in competitive cycling involves a risk of injury and illness. Much of the previously published literature on cycling-related health problems has focused on concussion or traumatic injuries of the upper and lower limbs occurring during road races and mountain biking (supplemental appendix 1). These studies are marked by heterogenous populations and vastly different methodologies, which complicate the interpretation and comparison of their results. Moreover, many cycling disciplines are either under-represented or not represented at all in the epidemiological literature. Hence, there is a need to standardise the recording and reporting of injuries and illnesses in cycling—across disciplines—to acquire more specific

knowledge on the incidence of injuries and illnesses, their types and risk factors. This information is necessary to develop effective policies and programmes to mitigate injury and illness risk.

In February 2020, the IOC released a consensus statement on methods for recording and reporting epidemiological data on injury and illness in sport.[4] This document, hereafter referred to as the IOC consensus statement, provided general guidelines to cover all sports-related injuries and illnesses. However, it was beyond the IOC consensus statement's scope to account for all sport-specific factors that may influence its applicability in every context. The IOC consensus group recommended that sport-specific extensions of the statement be written by clinicians and scientists with in-depth knowledge of these sports.[4]

In this consensus statement, we extend aspects of the IOC consensus statement to enable consistent application of its recommendations to epidemiological studies in cycling as a sport. The document applies to all disciplines currently regulated by the UCI, including para-cycling. We do not intend the paper to serve as a stand-alone document, but rather that it be read and applied in conjunction with the IOC consensus statement.

Methods

For this consensus statement, we followed similar procedures as were applied in previous extensions of the IOC consensus statement.[5 6] A panel of 20 experts from 11 countries convened to produce a consensus statement on injury and illness surveillance methodology in competitive cycling. This panel included sports physicians, sports scientists, epidemiologists, physiotherapists and strength and conditioning coaches with experience in the development of young cyclists, the training of elite cyclists and the organisation and medical assistance at international competitions of all disciplines of cycling. The panel included an athlete representative (LPN), who has competed at an elite level in three UCI disciplines (road cycling, mountain biking and cyclo-cross). A consensus meeting was held by video conference in July 2020 to discuss cycling-specific injuries, illnesses and health-monitoring issues, using the IOC consensus statement as a basis.[4] In the consensus meeting, participants discussed a first draft document of a cycling extension of the IOC consensus statement, prepared by VM-P, JDC, EV and BMP, and a list of specific topics to be discussed (supplemental appendix 2).

An expert in the epidemiology of sports-related injury (EV) moderated the consensus meeting. The meeting was recorded and transcribed by an administrative assistant. The consensus group agreed that standardising injury and illness recording in cycling is necessary and concurred that this should cover all UCI cycling disciplines. Cycling for transport and other forms of non-competitive cycling were deemed to be beyond the scope of the consensus statement. However, the group noted that many of the proposed guidelines may also be applicable in those contexts. It was agreed that the varied sport classes and impairment types of athletes competing in para-cycling add further complexity. Thus, an additional expert (CB) was recruited to ensure that the proposed translation was applicable to cyclists with impairment. After the meeting, BC, BMP and EV updated the draft manuscript to incorporate the statements agreed on by the expert panel. The manuscript was circulated in an iterative process until, after three rounds, all panel members agreed on the final version. Following the recommendation of Shrier,[7] all members were invited to provide a written minority opinion if they disagreed with any of the elements in the consensus statement. However, the panel reached agreement on all elements of the statement.

Consensus recommendations

Definitions of health problems, injury and illness

The IOC defines 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 seeks medical attention.[4] We believe this is an appropriate overarching definition for cycling research but highlight that the operational definition of a 'recordable' health problem is likely to vary between studies, depending on their research question.[8 9] Recording all health problems is recommended in studies aiming to gain a complete overview of the full spectrum of injuries and illnesses affecting cyclists, particularly those interested in capturing overuse injuries and chronic illnesses. However, a narrower definition such as if a health problem leads to time loss or medical attention may be appropriate in studies interested in traumatic injuries or major illnesses. For example, if a study is interested in rider safety during competition, a recordable health problem could be defined as one that leads to abandonment or hospitalisation.

Regarding the definitions of injury and illness, the methods for recording severity and the methods for recording multiple health problems, we consider the recommendations presented in the IOC consensus statement to be appropriate for cycling studies.

Mode of onset

Traditionally, the mode of injury onset has been classified in one of two ways: either by how quickly the injury presented (sudden onset or gradual onset) or by the assumed mechanism (single energy transfer/acute injury or repetitive energy transfer/overuse injury). The IOC consensus statement encourages researchers to develop a more nuanced classification system that accounts for mixed mechanisms and is also applicable to illnesses. Until such a system is developed and validated, we propose that cycling studies record, for all health problems, the presentation as either *sudden onset* or *gradual onset*. For injuries, the underlying mechanism should also be recorded as *acute* or *repetitive*, based on whether the injury was caused by a single or a cumulative transfer of kinetic energy. We acknowledge that this classification is based on the recorder's judgement, and for some injury types, it is likely to be inconsistently applied. However, due to its potential implications for developing prevention strategies, we believe the classification remains valuable. Cycling-specific examples of classifying the mode of injury onset are shown in table 1.

Table 1. Cycling-specific examples of classifying the mode of injury onset

Presentation Sudden or gradual onset?*	Underlying mechanism Single or cumulative transfer of kinetic energy?	Example
Sudden onset	Acute	A mountain biker crashes during a downhill competition, landing on her shoulder. X-ray shows a clavicular fracture.
Gradual onset	Repetitive	Example 1. Over a period of 1 month, a track cyclist feels an increasing pain below his kneecap. It starts as a slight discomfort at the beginning of training that disappears after warm-up. Eventually, the pain impedes pedalling during training. Ultrasound imaging shows patellar tendinopathy.
		Example 2. Over the course of a single 2-hour training session, a road cyclist develops severe anterior knee pain. Based on clinical examination, she is diagnosed with patellofemoral pain syndrome.
Sudden onset	Repetitive	An artistic cyclist is performing a routine when he feels a sudden pain in his right shoulder. Ultrasound imaging shows rotator cuff tendinopathy and subacromial bursitis.

- ***Sudden onset=instantaneous or developing over several seconds.**
- **Gradual onset=developing over minutes, hours or longer.**

Injury mechanisms and circumstances

Improved knowledge of injury mechanisms and circumstances in cycling will guide researchers, practitioners and other stakeholders (such as governing bodies, race organisers and equipment manufacturers) to develop effective preventive interventions.[10] The IOC consensus statement provides broad definitions of injury mechanisms. In box 1, we provide examples of cycling-specific collision agents, collision mechanisms, as well as potential related circumstances that may be related to injury causation.

Box 1. Categories of cycling-specific collision agents, collision mechanisms and related circumstances

Cyclist collided with

- A person/animal
  - Another cyclist.
  - Support staff member.
  - Spectator.
  - Official.
  - Pedestrian.
  - Animal.
- A vehicle
  - Car.
  - Motorcycle.
  - Bicycle.
- An inanimate object related to competition
  - Barrier.
  - Obstacle.
  - Advertising board.
- An inanimate object unrelated to competition
  - Street sign.
  - Kerb.
  - Fence.
  - Tree.
  - Rock.

- The ground only

Collision mechanism (multiple may apply)

- Surface quality
    - Pothole.
    - Tree-root damage.
- Equipment failure.
- Avoiding a person or animal
    - Another cyclist.
    - Support staff member.
    - Spectator.
    - Official.
    - Pedestrian.
    - Animal.
- Avoiding a loose object
    - Branch.
    - Bottle.
    - Stone/rock.
- Avoiding an inanimate object related to competition
    - Barrier.
    - Obstacle.
    - Advertising board.
- Avoiding an inanimate object unrelated to competition
    - Street sign.
    - Kerb.
    - Fence.
    - Tree.
    - Rock.
- Cyclist's own behaviour
    - Abrupt manoeuvre.
    - Braking mistake.
    - Lack of focus.
- Another cyclist's behaviour (intentional)
    - Pushing.
    - Slinging.
    - Cutting.
- Another cyclist's behaviour (unintentional)
    - Abrupt manoeuvre.
    - Braking mistake.
    - Lack of focus.
- Traffic related
    - Vehicle hitting the cyclist.
    - Cyclist hitting a vehicle.
    - Vehicle forcing the cyclist off the road.

Related circumstances (multiple may apply)

- Environmental factors
    - Wind.
    - Rain.
    - Snow.
    - Sand/dust.
    - High temperature.
    - Low temperature.
- Competition-specific factors
    - Phase of the race
        - Start.
        - Breaking away.

        - Sprint.
        - Climb.
        - Descent.
        - Feeding zone.
        - Bunch sprint.
    - Crash in a marked hazard zone
- Infringement of race or traffic regulations
    - By cyclist who crashed.
    - By another cyclist.
    - By a support staff member.
- Track surface
    - Road – asphalt.
    - Road – paved.
    - Gravel.
    - Sand.
    - Mud.
    - Wood.
    - Concrete.
- Technically difficult circuit/circuit section.
- Technically difficult routine or technical action.

Most cycling disciplines take place outdoors, where the environment (including the surface) often changes between different competitions or even between different days and weeks of the same event.[11] For these reasons, environmental factors, including surface conditions, air temperature, humidity, solar radiation, wind velocity and variations in air quality (air pollution, pollen and nitrogen dioxide) are all useful measures to add context to injury and illness surveillance. This information may be added to answer specific research questions.[12–14] There are currently no recommendations on the assessment of environmental conditions in sport. Cycling is not the only sport that is undertaken outdoors, and universal recommendations should be developed to support a uniform registry of these factors.

These suggestions are not meant to be used as a definitive classification system but rather a starting point for future cycling studies and surveillance systems to develop classifications relevant to their discipline, context and the research questions being addressed.

Describing injury mechanisms and related circumstances is only relevant for sudden-onset trauma. In contrast, the mechanisms of gradual-onset conditions are harder to determine because they occur over time and are often the result of the interaction of multiple factors.

Classifying sports injury and illness diagnoses

The IOC consensus statement provides recommendations for classifying injuries based on body area, tissue type and pathology type and for classifying illnesses based on the medical system and aetiology. To record specific diagnoses, the IOC statement encourages the use of sport-specific coding systems such as the Sports Medicine Diagnostic Coding System and the Orchard Sports Injury and Illness Classification System.[15] We support these recommendations, and in table 2, we provided codes for several cycling-related conditions, including ulnar neuropathy (‘handlebar palsy’),[16–19] pudendal neuropathy and other forms of cycling-related sexual and urinary dysfunction[18 20–26] and exercise-related external iliac artery flow limitations.[27–31]

Table 2. Recommended diagnostic codes for selected cycling-related health problems

Condition	Broad classification*	SMDCS-V2 code	OSIICS-13 code
Lateral hand numbness/ulnar neuropathy ('handlebar palsy')	Injury/wrist/nervous system/nerve injury/gradual onset, repetitive	Ulnar nerve entrapment (Tunnel of Guyon), WR.22.39	Wrist ulnar nerve injury, WNU
Numbness of the genitals or perineum/pudendal neuropathy/male or female sexual or urinary dysfunction	Injury/lumbosacral spine/nerve injury/gradual onset, repetitive	Pudendal nerve injury, LS.23.39	Pudendal nerve injury, LNP
Exercise-related iliac artery flow limitation	Injury/hip-groin/vessels/vascular trauma/gradual onset, repetitive	Exercise-related iliac artery flow limitation, HI.73.45	Exercise-related iliac artery flow limitation, GVI
Saddle sores (skin ailments on the buttocks, groin, inner thigh or genitals, related to contact with the bicycle saddle)	Illness/dermatological system/infection/gradual onset	Cellulitis/folliculitis, DE.06.75	Skin infection pelvis/buttock – including ischial abscess, MDIB
Stump lesions among cyclists with amputations	Injury/(specific body area)/stump /stump injury/(gradual or sudden onset, acute or repetitive)	See condition-specific codes: XX.91.00	Stump trauma, region-specific codes: UWS, QWS, TWS, EWS, RWS and KWS.

- ***Based on the IOC consensus categories. Injuries: body area/tissue type/pathology type/mode of onset; Illnesses: medical system/aetiology/mode of onset.**
- **EWS, stump trauma elbow; KWS, stump trauma knee; QWS, stump trauma lower limb; RWS, stump trauma forearm; TWS, stump trauma thigh; UWS, stump trauma upper arm.**

In our experience, it can be challenging to record consistent diagnostic codes for certain cycling-related skin conditions. For example, if a cyclist crashes and sustains a thigh abrasion that subsequently becomes infected, the incident could potentially be recorded as both an injury (thigh abrasion), an illness (dermatological infection) or both. As the initial cause was kinetic energy transfer, we recommend that all skin abrasions be recorded as injuries (table 2). If an athlete develops a local or systemic infection that warrants treatment with oral or intravenous antibiotics, this should be recorded separately as a subsequent local illness.

'Saddle sores' located on the genitals, inner thigh, and buttocks,[32] can also be difficult to code. They are sometimes considered injuries,[32] given that mechanical forces (pressure and friction) are involved in their development. However, because the primary pathology is follicle infection and because heat, moisture, and bacteria also play a key role, we recommend that saddle sores be recorded as illnesses (table 2).

Stump lesions among disabled cyclists typically occur in the context of increased or altered mechanical forces and thus should be recorded as injuries (table 2). If the cyclist develops a secondary local or systemic infection that warrants treatment with oral or intravenous antibiotics, this should be recorded separately as a subsequent local illness.

Key injury types

Based on clinical experience and literature review (supplemental appendix 1), we expect that most epidemiological studies of cycling are likely to record a predominance of acute sudden-onset injuries in the upper limb and shoulder and gradual-onset injuries to the knee. We recommend that studies report detailed injury data to at least the level of tissue and pathology type for those body areas. Ideally, specific diagnoses should also be reported.

Sport-related concussions remain a poorly quantified yet high priority injury problem in cycling.[33–37] The potential short-term and longer term repercussions of cyclists riding soon after suffering a concussion, before having made a full recovery, may be significant. To increase the recognition and sensitivity of the diagnosis of concussion, the UCI recently published a cycling-specific adaptation of the Sports Concussion Assessment Tool, version 5.[38 39] We encourage future studies to apply this protocol and report all concussions in as much detail as possible.

Key illness types

In studies of endurance cycling disciplines, we expect a relatively high rate of respiratory and gastrointestinal infections, as well as illnesses with allergic and environmental aetiologies (eg, hay fever, allergic and exercise-induced bronchoconstriction, heat illness and hypothermia). These illness types should be recorded and reported by both the organ system/region and the aetiology. Ideally, specific diagnoses should also be reported.

Capturing and reporting exposure

There is a wide range of cycling disciplines, each with unique characteristics. Therefore, we recommend measures of exposure specific to each UCI discipline (table 3). Risk exposure in training and competition should be reported separately using common units. If prerace warm-ups and postrace cool-down periods are recorded, it should be as training exposure.[40] In some instances, it may be appropriate to use additional measures of competition exposure (table 3).

Cycling offers a unique opportunity to quantify load in many ways, which may allow for highly accurate and novel ways of recording individual exposure. For example, power metres mounted on the bicycle or in the pedals enable real-time measurement of power output.[41–43] These data, along with other metrics such as heart rate and GPS,[44] can be used to generate a range of summary measures of training load, such as the Training Stress Score (TSS),[11] and the Training Impulse (TRIMP).[45 46] These are commonly used by cyclists and coaches to analyse and plan training and competition and have the potential to be used in studies investigating the relationship between cycling loads and injury risk.[47] As these measures encompass both cycling duration and intensity, they may also be valuable as supplementary exposure measures in basic epidemiological research. For example, injury incidence rates could be expressed per 10 000 TSS units, as well as per 1000 hours. However, this approach has not been validated, and researchers should be aware that the same score may describe a different response to exercise. For example, a cyclist can record similar TSS and TRIMP scores from a high intensity/low volume session and a low intensity/high volume session.[48 49]

Currently, power metres, training management software and GPS are mainly used in road cycling, cyclo-cross and mountain biking. Power metres are also widely used in track cycling training, but they are currently not allowed in competition.

In disciplines where the impulses exerted on the bike are determinants of success, such as trials and BMX freestyle, cyclists are increasingly using new wearable inertial sensors comprising accelerometers and gyroscopes.[50] These may also offer the potential for discipline-specific forms of exposure measurement in future epidemiological studies.

Table 3. Recommended exposure measures for each UCI cycling discipline

Discipline	Events/subdiscipline	Preferred exposure measures
Road cycling	• **All events, including para-cycling.**	1000 hours of training/competition. 100 race days.*
Track cycling	Sprint events, including para-cycling • **Individual sprint.** • **Team sprint.** • **1000 m/500 m time trial.** • **Keirin.** • **Para-cycling only: tandem sprint.**	100 starts.
	Endurance events, including para-cycling • **Individual pursuit.** • **Team pursuit.** • **Points race.** • **Madison.** • **Scratch race.**	1000 hours of training/competition.
Mountain bike	Endurance events • **Mountain bike cross-country.** • **Enduro.** • **Eliminator.** • **E-mountain bike.**	1000 hours of training/competition. 100 race days.*
	Non-endurance events • **Mountain bike downhill.** • **Four-cross.** • **Alpine snow bike.**	100 runs.
Cyclo-cross	• **All events.**	1000 hours of training/competition. 100 race days*
BMX	• **Racing—all events.**	1000 hours of training/competition. 100 runs.
	• **Freestyle park competition.**	1000 hours of training/competition. 100 runs.
Trials	All events.	1000 hours of training/competition 100 runs
Indoor cycling	Artistic cycling and all events.	1000 hours of training/competition. 100 routines.
	Cycle ball.	1000 hours of training/competition. 100 matches.

- ***Supplementary measure of competition exposure.**
- **UCI, Union Cycliste Internationale.**

Expressing risk

The risk of injury and illness in cycling should be reported as incidence and prevalence. The IOC consensus statement defines incidence as the number of new injuries/illnesses in the population that develop during a specified period.[4] Prevalence is a proportion that refers to the number of existing cases at a given point in time (point prevalence) or in a specific period (period prevalence) divided by the total population at risk.[4] A survey of top-level road cyclists showed that injuries occurred more frequently in training than in competition but that competition-related injuries were more severe.[51] We, therefore, recommend that incidence is calculated separately for training and competition. Depending on the cycling discipline, we recommend expressing the number of injuries per 1000 hours, race days, starts, runs, matches or routines (table 3). We do not recommend expressing the number of injuries per 1000 km (or any other distance), because the demands of riding the same distance can vary greatly in different conditions (eg, flat vs mountainous terrain).

To compare injury and illness incidence between groups of cyclists with fundamentally different types of preferred exposure (eg, sprint and endurance track cycling, cross-country and downhill mountain biking, BMX racing and BMX freestyle), rates should be calculated per 365 athlete-days.

Study population characteristics

As a minimum, the following population characteristics should be recorded: age, sex, cycling discipline, level of cycling, and in para-cycling, the rider's sport classification, impairment type and diagnosis (table 4).

Depending on the research question, other relevant characteristics such as height, body mass, training and competition volume (hours/week), years of competitive experience in the relevant age category and previous health problem(s) may be relevant. Studies of elite cyclists should report, while respecting confidentiality, the approximate range of UCI rankings of the participants.

The level of cycling can be defined as recreational, amateur or professional. A recreational cyclist is defined as someone who cycles as a regular form of exercise without participating in competitions. An amateur is a cyclist who practices cycling for non-economic reasons, irrespective of whether they participate in official competitions. A professional is a cyclist who receives salary or income for their involvement in the sport. This classification is mostly relevant for road cycling, which is the discipline with the largest number of professionals (particularly among males). In other disciplines, it may be more pertinent to classify cyclists as recreational, subelite and elite. In general, we define an elite cyclist as one who competes at a high national or international level in their chosen discipline and age group. However, this is likely to vary substantially between countries, disciplines and age groups. We, therefore, encourage all cycling researchers to describe the competitive level of their subjects in detail to facilitate comparison between studies.

Table 4. Classification scheme for elite para-cycling

Equipment	Classification category	Impairment types and examples of associated diagnoses
Bicycle	C division (C1–C5)	Impaired muscle power • **Spinal cord disorders and muscular dystrophy.** Impaired passive range of motion • **Arthrogryposis and joint contracture.** Leg length difference • **Dysmelia.** Limb deficiency • **Traumatic or non-traumatic amputation.** Hypertonia/ataxia/athetosis • **Cerebral palsy, brain injury and stroke.**
Tricycle	T division (T1–T2)	Hypertonia/ataxia/athetosis • **Cerebral palsy, brain injury and stroke.**
Handcycle	H division (H1–H5)	Impaired muscle power • **Spinal cord disorders and muscular dystrophy.** Impaired passive range of motion • **Arthrogryposis and joint contracture.** Limb deficiency • **Traumatic or non-traumatic amputation.** Hypertonia/ataxia/athetosis • **Cerebral palsy, brain injury and stroke.**
Tandem bicycle	B division	Visual impairment.

UCI competitions such as the World Championships are held separately for males and females and according to a range of age categories including 'Junior' (17 and 18 years), 'Under 23' (19–22 years) and 'Elite' (23 years and older). Some disciplines also include the categories of 'Youth' (16 years and under) and 'Masters' (30 years and older, with 5-year subcategories). These categories may be appropriate for use in epidemiological studies. However, it would be preferable to combine the Under 23 and Elite categories in many cases because many elite cycling competitions do not differentiate between these groups (eg, most professional road cycling races, Olympic Games and BMX World Championships). Additionally, to avoid conflicting terminology and allow universal application, we recommend that epidemiological studies use the term 'Adult' instead of 'Elite' when referring to the (open) category for adults.

Study design and data collection methods

Epidemiological studies in cycling should ideally have a prospective design. Depending on the resources and study question at hand, other designs, however, can also be considered. The current recommendations should remain applicable. Depending on the context of surveillance, it may be appropriate to collect data using team medical personnel, race medics, coaches and/or from cyclists themselves. All study protocols should be approved by an appropriate ethical review committee and conform to the World Medical Association's code of ethics.[52] Each cyclist should be adequately informed of what is expected from him or her, the duration of the data collection, the possible risks and benefits of study participation, the reporting of results (at individual or group level) and sign an informed consent form. For research with minors, permission from at least one parent or legal guardian is required, in addition to the assent of the child. The data must be stored in a secure format to preserve confidentiality, and all handling of sensitive data must comply with local and regional data security regulations.

Ideally, data should be collected using electronic registration systems. In cases where paper registrations are necessary, we encourage the use of the IOC consensus statement's Daily Medical Report on Injuries and Illnesses.

Call to action

In this paper, we have extended the recommendations of the IOC consensus statement, such that they can be consistently applied to epidemiological studies across UCI cycling disciplines.

The scientific literature on injuries and illnesses in cycling is currently marked by studies with heterogeneous methodology, many of which involve small numbers of participants or have a short period of data collection. For many cycling disciplines, no epidemiological information is available. This is concerning, as such information is the cornerstone of the development of measures protecting athletes' health. We foresee that this consensus statement will facilitate new, high-quality epidemiological research across all cycling disciplines and levels and among under-represented athlete groups.

We draw attention to para-cyclists who have received little research attention to date. Given that para-athletes often have a complex medical background, it is of utmost importance to implement surveillance programmes to guide and promote athlete safety in this athletic population.

We also highlight the recent IOC Consensus statement on relative energy deficiency in sport .[53] This is a highly relevant issue for cyclists of both sexes and has received little research attention to date.

The ultimate goal of epidemiological research in cycling is to guide protection and optimisation of cyclists' health. The UCI has recently made substantial efforts towards this goal, particularly in elite road cycling, with the planned introduction of a range of practical measures dedicated to rider safety.[54] We applaud these efforts and hope that this consensus statement provides a framework by which their effect can be evaluated, along with future preventative interventions across all disciplines and levels of cycling.

Conclusion

This extension of the IOC consensus statement will improve the consistency, accuracy and quality of injury and illness surveillance programmes across all UCI cycling disciplines.

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