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Injuries and illnesses at the Munich 2022 European Championships: a prospective study of 5419 athletes from 52 countries involved in 9 sports

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ABSTRACT

Objective To describe the incidence and characteristics of the sports injuries and illnesses that occurred during the 2022 European Championships.

Methods We conducted a prospective study on newly incurred injuries and illnesses collected by the national medical teams and the local organising committee physicians using a standardised online report form on a daily basis, in all athletes registered at the 2022 European Championships from 11 August 2022 to 21 August 2022 in Munich (Germany).

Results In total, 5419 athletes were registered at the 2022 European Championships in 9 sports. A total of 181 in-competition injuries were reported, representing an overall incidence of 33.4 injuries per 1000 registered athletes, with higher values in triathlon, cycling and athletics. More injuries located at the lower limb and involving the muscles and skin were reported in athletics, at the lower limb and involving the skin in triathlon, at the head and trunk and upper limb and involving head and skin in cycling. A total of 65 illnesses were reported, representing an overall incidence of 12.0 illnesses per 1000 registered athletes, with higher values in athletics and rowing. The most affected common system was the cardiovascular system (24.6%), followed by the gastrointestinal (18.5%) and upper respiratory tracts (16.9%). The most frequent causes were exercise (36.9%), infections (30.8%) and 'others' (10.8%).

Conclusion This was the first injury and illness surveillance during multisports European Championships providing relevant results to help anticipate medical services and athletes' health protection, and highlighting the need for special attention for triathlon and cycling.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ International multisports events, such as Olympic Games and recently the European Championships, are representing a challenge for organising committee on the medical aspects.

⇒ Injury and illness surveillances are of great interest for athletes' health protection and anticipating medical services in such multievents championships.

⇒ Injury and illness surveillances are performed as a routine during summer Olympic Games, reporting that about 10% of athletes incurred at least one injury and 4% at least one illness, with variation according to sports.

WHAT THIS STUDY ADDS

⇒ During the competition period of the 2022 European Championships, 33 in-competition injuries and 12 illnesses per 1000 registered athletes were reported.

⇒ The injury incidences and characteristics varied with sports and sex, with higher incidences reported in triathlon for both female and male athletes, and in cycling for female athletes.

⇒ The illness incidences and characteristics varied with sports and sex, with higher incidences reported in athletics for both female and male athletes, and rowing more specifically for female athletes.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ These results can be of help for medical teams (local organising committee and national teams) to improve, for future European Championships, their medical and emergency plans, optimise their healthcare and enhance risk reduction measures according to the diagnoses and risk profiles of their athlete populations. Efforts should focus on triathlon and cycling, for which higher values of injury incidences have been reported. Improvement in injury and illness surveillance implementation is needed for the next European Championships (eg, more information and education of medical teams).

INTRODUCTION

Athletes are training over years to perform at their best during major championships. However, during these major events, they also bear the risk of sustaining an injury or an illness,[1–4] which may reduce their chance of performance,[5 6] in addition to non-negligible consequences on their health at short, middle and long term.[7] Therefore, injury and illness prevention represents a relevant challenge in sports. The first fundamental step in this challenge is to know the extent of the injury and illness problem through

epidemiological studies, helping to orient research on injury and illness prevention and especially the development of their prevention strategies.[8] There are other reasons supporting the interest of collecting injury and illness data in sports.[9] Knowing the potential number of expected injuries and illnesses is of great help in anticipating medical services (personals, materials, organisations) during such major championships.[10] It also allows orienting the medical teams' education on the most frequent and severe expected injuries and illnesses. It can be of help to orient the injury and illness prevention strategies to better prepare athletes for these major championships.[10] And finally, it allows monitoring of injuries and illnesses in the long term in an athletes' health protection project.[9] Therefore, injury and illness surveillance is now routine in the Summer Olympic Games,[1–4 11] Winter Olympic Games,[12–14] FIFA World Cup,[15 16] European Athletics Championships[10 17] and have been implemented in some other major championships, such as Aquatics[18] and Youth Olympic Games.[19 20]

The European Championships (https://www.europeanchampionships.com) is a new continental event, taking place every 4 years, gathering during the same period and at the same location the European Championships of several sports. As for other mult-events championships, such as Olympic Games, the European Championships represent a logistical challenge for the organisers, especially in providing healthcare to international high-level athletes. Health facilities and medical teams need to be adapted to the specific requirements of each sport to ensure and provide high-quality medical care.[21 22]

In this context, we aimed to describe the incidence and characteristics of the sports injuries and illnesses occurring during the 2022 European Championships in Munich.

METHODS

Study design and overall procedure

We conducted a prospective cohort study (total population study) with the data collection of newly incurred injuries and illnesses in all athletes registered at the 2022 European Championships from 11 August 2022 to 21 August 2022 in Munich (Germany). The 2022 European Championships gathered during the same period and location the European Championships of athletics, beach volleyball, canoe sprint, cycling, gymnastics, rowing, sport climbing, table tennis and triathlon.[23]

The study protocol was reviewed and approved by the Saint-Etienne University Hospital Ethical Committee (Institutional Review Board: IORG0007394; IRBN792022/CHUSTE) and the Ethical Committee of the Technical University of Munich (Institutional Review Board: 2022-94-S-NP). All athletes were informed about the study aim and procedure and that their data is used for research, as well as about their rights to refuse that their data be used for research, by (1) poster displayed on the different venues of the championships, (2) a flyer given to each athlete with the accreditation, (3) emails sent by their national federations and (4) volunteers at the different venues during the whole period of the championships and informing the athletes about this study.[23] No signed informed consent was required by the ethical committees.

Patient and public involvement

There were no public and patient involvement. A summary of the study results will be disseminated to the public.

Equity, diversity and inclusion statement

All athletes registered at the 2022 European Championships in Munich were eligible for this study without any restriction based on sex, race/ethnicity/culture, socioeconomic level or representation from marginalised groups. Apart from sex, age and sports discipline no other characteristics were collected from the participants and were thus considered in the analysis and interpretation of results.

The author team included four men, one junior and three senior researchers, from a variety of disciplines (sports medicine, physical medicine and rehabilitation, orthopaedics, sports sciences and data sciences), and from two countries in Europe (France and Germany).

Population

The targeted population included all female and male athletes, registered at the 2022 European Championships in Munich to participate in at least one event of one of the nine sports of the European Championships. There were no exclusion criteria.

Injury and illness definitions

We used the same definitions as those used in injury and illness surveillance during athletics international championships.[10 17]

Injury was defined as: 'all musculoskeletal injuries (traumatic and overuse) and concussion newly incurred during competition or training regardless of the consequences with respect to the athlete's absence from competition or training'.[10 24 25] In cases where a single incident resulted in more than one injured body part and/or type of injury, each body part and/or type injury was counted as a separate injury.[10] We used the classification of locations, types (grouped according to the type of tissue: muscle, tendon, ligament, articular, bone, skin and others[10]), causes (grouped into overuse, traumatic and others[10]), severities and circumstances described in the consensus statement for epidemiological studies in athletics.[25]

An illness was defined as 'a physical or psychological complaint or manifestation by an athlete not related to injury, regardless of its consequences with respect to impairments in connection with competition or training'.[17 25 26] We used the classification of systems affected, causes (without distinction between sudden and gradual onset) and severity, described in the consensus statement for epidemiological studies in athletics.[17 25]

Data collection procedure

We used the same data collection procedure as used in injury and illness surveillance during athletics international championships.[10 17]

The local organising committee (LOC) physicians and the national medical teams registered at the 2022 European Championships in Munich were informed about the study 1 month before the championships by an email sent by the study team to the 2022 European Championships organising committee, who were asked to forward it to (1) the LOC physicians and (2) the European Sports Federations, and then to their national member sports Federations with the final aim to forward to their national medical teams participating at the 2022 European Championships. At the start of the 2022 European Championships, during the delegates meetings in each sport, the study aim and procedure were again explained in order to encourage the LOC physicians and the national medical teams to participate in this study. In addition, the information was also presented during the team managers meetings in all sports (head of delegation). During the period of the 2022 European Championships in Munich from 11 August 2022 to 21 August 2022, the information regarding the study was regularly reminded to the LOC physicians and the medical teams by volunteers at the different venues during the whole period of the championships.

During the period of the 2022 European championships, the LOC physicians and the national medical teams were asked to report all injuries and illnesses that newly occurred daily using an online web application (IPrevApp, https://iprevapp.emse.fr) or a paper form. The LOC physicians were provided with mobile tablets (ninth-generation iPad, Apple) to collect injury and illness data. The national medical teams used their own informatic materials (smartphones or personal computers). Each national medical team and the head LOC physician of each sport received the weblink to the online web application (https://iprevapp.emse.fr) as well as a login and password. In addition, a team of medical and sports science students has been recruited to assist the LOC and the national medical teams at the venues with the data collection. Prior to the event, the methods of data collection (ie, classifications and online web application) were explained to the medical and sports science students so that they could assist the LOC and the national medical teams. Such as in previous injury and illness surveillances during athletics international championships,[10 17 27] the issue of duplicate reporting between the LOC and the national medical teams was solved by the consensus of two authors (PE and PED); information from the national team physician's report was preferred over the LOC physician's report. All information was handled confidentially so that reidentification after the 2022 European Championships was impossible and we could ensure the pseudoanonymity of all athletes.

Given that the 2022 European Championships was a continental championship, with short travel for most of the teams, and that some athletes could arrive only for their competition (only a few days on-site) and not be on site for the total period of the 2022 European Championships (11 August 2022 to 21 August 2022), we only included in the present analysis, injuries and illnesses occurring during the days of competition for each sport (table 1), and during competition for injuries (in-competition injuries).

Statistical analyses

We performed descriptive analyses using frequency and percentages for categorical data and means and SDs for continuous variables, and by calculating the in-competition injury and illness incidence as a number of injuries or illnesses per 1000 registered athletes (with 95% CI).

RESULTS

Population, participation and response rate

A total of 5419 athletes (2374 (44%) female and 3045 male (56%) athletes) were registered at the 2022 European Championships in 9 sports and from 52 countries. Most of the athletes were registered in athletics (28.4%), followed by rowing (15.9%) and cycling (14.7%) (table 1). After all athletes were informed about the study aim and procedure, that their data were used for research, and about their rights to refuse that their data be used for research, none of the 5419 registered athletes refused to allow their data to be used for scientific research.

A total of 126 national medical teams were registered at the 2022 European Championships in 7 sports and from 37 countries; no national medical teams were registered for canoe sprint and table tennis (table 1). Among them, 36 were accepted to participate in this study, ranging from 0 in beach volleyball, gymnastics, rowing and table tennis, to 1 (8.3%) in sport climbing and triathlon, and 93.9% in athletics (table 1). In total about one-third of all registered athletes at the 2022 European Championships (29.3%) were covered by national medical teams participating in this study, however, there was no coverage for 5 sports (beach volleyball, canoe sprint, gymnastics, rowing, and table tennis), 1.9% of registered athletes were covered for climbing, 4.9% for cycling, 5.5% for triathlon and 93.4% for athletics (table 1). The response rates to the daily reports by national medical teams ranged from 14.3% to 100% (table 1). The response rates by the LOC physicians ranged from 28.6% to 100.0% (table 1).

Injuries

A total of 181 in-competition injuries were reported during the competition period of each sport (table 2). Most of the injuries were reported in cycling (n=60), athletics (n=54) and triathlon (n=39) (table 2). The overall in-competition injury incidence was 33.4 injuries per 1000 registered athletes (95% CI 28.6 to 38.2), with variation according to sex and sports: higher incidences were reported in triathlon for both female and male athletes, and in cycling for female athletes (table 2).

Table 1 Information regarding the population and participation at the injury and illness surveillance at the 2022 European Championships in Munich: number and percentage of participating countries, registered medical teams, registered athletes and response rate

Sport	Total	Athletics	Beach volleyball	Canoe sprint	Cycling	Gymnastics	Rowing	Sport climbing	Table tennis	Triathlon
Period (dates of competition)	11 August-21 August	15 August-21 August	15 August-21 August	18 August-21 August	11 August-21 August	11 August-21 August	11 August-14 August	11 August-19 August	13 August-21 August	12 August-14 August
No of days of competition (n)	11	7	7	4	10	6	4	7	9	3
Registered countries and athletes										
No of countries with at least one athlete registered at the European Championships (n)	52	48	23	37	40	40	33	27	39	31
Total no of registered athletes (n)	5419	1540	225	695	798	559	864	318	257	163
Distribution of the total registered athletes according to sports (%)	100.0	28.4	4.2	12.8	14.7	10.3	15.9	5.9	4.7	3.0
Medical teams participation										
No (percentage) of countries with a registered medical team	37 (71.2)	33 (68.8)	11 (47.8)	0 (0.0)	17* (47.2*)	32 (80.0)	9 (27.3)	12 (44.4)	0 (0.0)	12 (38.7)
No (percentage) of medical teams participating in this surveillance study	–	31 (93.9)	0 (0.0)	0 (0.0)	3* (17.6*)	0 (0.0)	0 (0.0)	1 (8.3)	0 (0.0)	1 (8.3)
No (percentage) of registered athletes with medical team participating in this surveillance study	1464* (29.3*)	1439 (93.4)	0 (0.0)	0 (0.0)	18* (4.9*)	0 (0.0)	0 (0.0)	6 (1.9)	0 (0.0)	9 (5.5)
Response rate (percentage of daily report forms compared with the maximum expected)	–	100.0	0	0	50.0*	0	0	14.3	0	66.7
Local organising committee participation										
Response rate (percentage of daily report forms compared with the maximum expected)	–	100.0	71.4	100.0	100	66.7	100.0	28.6	100.0	88.9

*For cycling data are only for the road cycling discipline.
LOC, local organising committee.

Table 2 Number of in-competition injuries and illnesses, and number of in-competition injuries and illnesses per 1000 registered athletes (with 95% CI), per sports and sex, during the 2022 European Championships in Munich

	Total	Athletics	Beach volleyball	Canoe sprint	Cycling	Gymnastics	Rowing	Sport climbing	Table tennis	Triathlon
Registered athletes (n)										
Total no of registered athletes	5419	1540	225	695	798	559	864	318	257	163
No of registered female athletes	2374	735	102	248	333	260	354	142	123	77
No of registered male athletes	3045	805	123	447	465	299	510	176	134	86
Injuries										
Total no of injuries	181	54	9	0	60	4	7	3	5	39
No of injuries per 1000 registered athletes (95% CI)	33.4 (28.6 to 38.2)	35.1 (25.9 to 44.3)	40.0 (14.4 to 65.6)	0.0	75.2 (56.9 to 93.5)	7.2 (0.2 to 14.1)	8.1 (2.1 to 14.1)	9.4 (–1.2 to 20.1)	19.5 (2.6 to 36.3)	239.3 (173.8 to 304.8)
No of injuries in female athletes	106	28	4	0	43	4	1	2	1	23
No of injuries per 1000 registered female athletes (95% CI)	44.7 (36.3 to 53.0)	38.1 (24.3 to 51.9)	39.2 (1.5 to 76.9)	0.0	129.1 (93.1 to 165.1)	15.4 (0.4 to 30.3)	2.8 (–2.7 to 8.4)	14.1 (-5.3 to 33.5)	8. 1(–7.7 to 24.0)	298.7 (196.5 to 400.9)
No of injuries in male athletes	75	26	5	0	17	0	6	1	4	16
No of injuries per 1000 registered male athletes (95% CI)	24.6 (19.1 to 30.1)	32.3 (25.9 to 44.5)	40.7 (21.4 to 75.6)	0.0	36.6 (26.5 to 53.6)	0.0	11.8 (6.2 to 21.1	5.7 (–0.5 to 16.8)	29.9 (14.7 to 58.7)	186.0 (140.4 to 268.3)
Illnesses										
Total no of illnesses	65	41	1	2	4	0	17	0	0	0
No of illnesses per 1000 registered athletes (95% CI)	12.0 (9.1 to 14.9)	26.6 (18.6 to 34.7)	4.4 (–4.2 to 13.1)	2.9 (–1.1 to 6.9)	5.0 (0.1 to 9.9)	0.0	19.7 (10.4 to 28.9)	0.0	0.0	0.0
No of illnesses in female athletes	35	30	1	1	3	0	10	0	0	0
No of illnesses per 1000 registered female athletes (95% CI)	14.7 (9.9 to 19.6)	40.8 (26.5 to 55.1)	9.8 (–9.3 to 28.9)	4.0 (–3.9 to 11.9)	9.0 (–1.1 to 19.2)	0.0	28.2 (11.0 to 45.5)	0.0	0.0	0.0
No of illnesses in male athletes	30	21	0	1	1	0	7	0	0	0
No of illnesses per 1000 registered male athletes (95% CI)	9.9 (6.3 to 13.4)	26.1 (15.1 to 37.1)	0.0	2.2 (–2.1 to 6.6)	2.2 (–2.1 to 6.4)	0.0	13.7 (3.6 to 23.8)	0.0	0.0	0.0

Table 3 Characteristics of in-competition injuries presented as numbers (%), for location, type, cause and severity, and their distribution according to sports, during the 2022 European Championships in Munich

	Total	Athletics	Beach volleyball	Canoe sprint	Cycling	Gymnastics	Rowing	Sport climbing	Table tennis	Triathlon
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Total	181 (100.0)	54 (100.0)	9 (100.0)	0 (0.0)	60 (100.0)	4 (100.0)	7 (100.0)	3 (100.0)	5 (100.0)	39 (100.0)
Location										
Head and trunk	35 (19.3)	7 (13.0)	1 (11.1)	0 (0.0)	16 (26.7)	1 (25.0)	6 (85.7)	0 (0.0)	1 (20.0)	3 (7.7)
Head and face	14 (7.7)	1 (1.9)	1 (11.1)	0 (0.0)	9 (15.0)	1 (25.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (5.1)
Neck/cervical spine	4 (2.2)	0 (0.0)	0 (0.0)	0 (0.0)	3 (5.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (20.0)	0 (0.0)
Sternum/ribs/abdomen	6 (3.3)	1 (1.9)	0 (0.0)	0 (0.0)	4 (6.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.6)
Lumbar spine	9 (5.0)	4 (7.4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	5 (71.4)	0 (0.0)	0 (0.0)	0 (0.0)
Upper extremity	44 (24.3)	4 (7.4)	4 (44.4)	0 (0.0)	19 (31.7)	0 (0.0)	1 (14.3)	2 (66.7)	4 (80.0)	10 (25.6)
Shoulder/clavicle	14 (7.7)	1 (1.9)	0 (0.0)	0 (0.0)	10 (16.7)	0 (0.0)	0 (0.0)	0 (0.0)	1 (20.0)	2 (5.1)
Elbow	10 (5.5)	0 (0.0)	1 (11.1)	0 (0.0)	4 (6.7)	0 (0.0)	0 (0.0)	0 (0.0)	1 (20.0)	4 (10.3)
Upper arm and forearm	5 (2.8)	0 (0.0)	0 (0.0)	0 (0.0)	2 (3.3)	0 (0.0)	1 (14.3)	1 (33.3)	0 (0.0)	1 (2.6)
Hand	15 (8.3)	3 (5.6)	3 (33.3)	0 (0.0)	3 (5.0)	0 (0.0)	0 (0.0)	1 (33.3)	2 (40.0)	3 (7.7)
Lower extremity	102 (56.4)	43 (79.6)	4 (44.4)	0 (0.0)	25 (41.7)	3 (75.0)	0 (0.0)	1 (33.3)	0 (0.0)	26 (66.7)
Pelvis/sacrum/buttock/hip/groin	19 (10.5)	4 (7.4)	0 (0.0)	0 (0.0)	13 (21.7)	0 (0.0)	1 (14.3)	0 (0.0)	0 (0.0)	1 (2.6)
Thigh anterior	5 (2.8)	2 (3.7)	0 (0.0)	0 (0.0)	2 (3.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.6)
Thigh posterior	18 (9.9)	17 (31.5)	1 (11.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Knee	23 (12.7)	8 (14.8)	1 (11.1)	0 (0.0)	10 (16.7)	1 (25.0)	0 (0.0)	1 (33.3)	0 (0.0)	2 (5.1)
Lower leg	5 (2.8)	5 (9.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Achilles tendon	1 (0.6)	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Ankle	12 (6.6)	6 (11.1)	1 (11.1)	0 (0.0)	0 (0.0)	2 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (7.7)
Foot	21 (11.6)	1 (1.9)	1 (11.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	19 (48.7)
Type										
Concussion	11 (6.1)	0 (0.0)	0 (0.0)	0 (0.0)	10 (16.7)	1 (25.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Muscle	32 (17.7)	23 (42.6)	1 (11.1)	0 (0.0)	1 (1.7)	0 (0.0)	4 (57.1)	1 (33.3)	2 (40.0)	0 (0.0)
Tendon	4 (2.2)	4 (7.4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Ligament	20 (11.0)	5 (9.3)	4 (44.4)	0 (0.0)	1 (1.7)	3 (75.0)	0 (0.0)	1 (33.3)	0 (0.0)	6 (15.4)
Articular	11 (6.1)	6 (11.1)	1 (11.1)	0 (0.0)	1 (1.7)	0 (0.0)	1 (14.3)	0 (0.0)	0 (0.0)	2 (5.1)
Bone	6 (3.3)	1 (1.9)	1 (11.1)	0 (0.0)	3 (5.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (20.0)	0 (0.0)
Skin	87 (48.1)	12 (22.2)	2 (22.2)	0 (0.0)	43 (71.7)	0 (0.0)	0 (0.0)	1 (33.3)	2 (40.0)	27 (69.2)
Others	10 (5.5)	3 (5.6)	0 (0.0)	0 (0.0)	1 (1.7)	0 (0.0)	2 (28.6)	0 (0.0)	0 (0.0)	4 (10.3)

Continued

Table 3 Continued

	Total	Athletics	Beach volleyball	Canoe sprint	Cycling	Gymnastics	Rowing	Sport climbing	Table tennis	Triathlon
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Cause										
Overuse	36 (19.9)	9 (16.7)	1 (11.1)	0 (0.0)	0 (0.0)	0 (0.0)	7 (100.0)	0 (0.0)	0 (0.0)	19 (48.7)
Traumatic	145 (80.1)	45 (83.3)	8 (88.9)	0 (0.0)	60 (100.0)	4 (100.0)	0 (0.0)	3 (100.0)	5 (100.0)	20 (51.3)
Severity										
No time loss	72 (39.8)	20 (37.0)	5 (55.6)	0 (0.0)	41 (68.3)	0 (0.0)	0 (0.0)	3 (100.0)	2 (40.0)	1 (2.6)
Time loss from 1 to 7 days	71 (39.2)	12 (22.2)	2 (22.2)	0 (0.0)	11 (18.3)	2 (50.0)	7 (100.0)	0 (0.0)	0 (0.0)	37 (94.9)
Time loss from 8 to 28 days	24 (13.3)	17 (31.5)	2 (22.2)	0 (0.0)	3 (5.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (20.0)	1 (2.6)
Time loss >28 days	14 (7.7)	5 (9.3)	0 (0.0)	0 (0.0)	5 (8.3)	2 (50.0)	0 (0.0)	0 (0.0)	2 (40.0)	0 (0.0)

Regarding the characteristics of in-competition injuries, 56.4% were located at the lower limb, 24.3% upper limb and 19.3% head and trunk (table 3). More precisely, the knee was the most frequent injury location (12.7%), followed by the foot (11.6%), the pelvis/sacrum/buttock/hip/groin (10.5%) and the posterior thigh (9.9%) (tables 3 and 4). The skin was the most frequently reported injury type (48.1%), followed by the muscle (17.7%) and the ligament (11.0%) (table 3). Most of the injuries were caused by traumatic causes (80.1%) and the remains by overuse (19.9%) (table 3). Most of the injuries led to minor consequences: 39.8% were no-time-loss estimated injuries, 39.2% led to 1–7 estimated days of absence, 13.3% led to 8–28 estimated days of absence and 7.7% led to more than 28 days (table 3). The 14 injuries with an estimated time loss higher than 28 days were reported in athletics (n=5), cycling (n=5), gymnastics (n=2) and table tennis (n=2). There were four bone (fractures), three skin, three ligament, one concussion, one muscle, one tendon and one articular injuries. The numbers of in-competition injuries by location and type, as well as their distribution in sports, are presented in table 4.

Illnesses

A total of 65 illnesses were reported during the competition period of each sport (table 2). Most of the illnesses were reported in athletics (n=41) and rowing (n=17) (table 2). The overall illness incidence was 12.0 illnesses per 1000 registered athletes (95% CI 9.1 to 14.9), with variation according to sex and sports: higher incidences were reported in athletics for both female and male athletes, and rowing more specifically for female athletes (table 2).

The most common system affected by illness was the cardiovascular system (24.6%), followed by the gastrointestinal tract (18.5%) and the upper respiratory tract (16.9%) (table 5). The most frequent causes were exercise (36.9%), infections (30.8%) and 'others' (10.8%) (table 5). Half of the illnesses (50.8%) were expected to result in time-loss from sport (table 5). The estimated time-loss from sport was one to 7 days (minor severity) in 43.1% of illnesses and eight to 28 days (moderate severity) in 6.2%. The numbers of illnesses by affected system, cause and severity, as well as their distribution in sports, are presented in table 5.

DISCUSSION

The main findings of this study were that (1) 33 in-competition injuries and 12 illnesses per 1000 registered athletes were reported during the competition period of the 2022 European Championships from 11 August 2022 to 21 August 2022 in Munich (Germany) and (2) the injury and illness incidences and characteristics varied with sports and sex.

As previously mentioned, conducting injury and illness surveillance represents an important aspect of athletes' health protection.[89] We, thus, conducted injury and illness

Table 4 Number (and percentage (%)) of in-competition injuries by location and type, as well as their distribution according to sports, during the 2022 European Championships in Munich

	Total	Athletics	Beach volleyball	Canoe sprint	Cycling	Gymnastics	Rowing	Sport climbing	Table tennis	Triathlon
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Total	**181 (100.0)**	**54 (100.0)**	**9 (100.0)**	**0 (0.0)**	**60 (100.0)**	**4 (100.0)**	**7 (100.0)**	**3 (100.0)**	**5 (100.0)**	**39 (100.0)**
Head and face	**14 (7.7)**	**1 (1.9)**	**1 (11.1)**	**0 (0.0)**	**9 (15.0)**	**1 (25.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**2 (5.1)**
Concussion	7 (3.9)	0 (0.0)	0 (0.0)	0 (0.0)	6 (10.0)	1 (25.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Skin	4 (2.2)	0 (0.0)	1 (11.1)	0 (0.0)	3 (5.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Others	3 (1.7)	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (5.1)
Neck/cervical spine	**4 (2.2)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**3 (5.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**1 (20.0)**	**0 (0.0)**
Concussion	2 (1.1)	0 (0.0)	0 (0.0)	0 (0.0)	2 (3.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Muscle	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (20.0)	0 (0.0)
Skin	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Sternum/ribs/abdomen	**6 (3.3)**	**1 (1.9)**	**0 (0.0)**	**0 (0.0)**	**4 (6.7)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**1 (2.6)**
Concussion	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Ligament	1 (0.6)	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Skin	2 (1.1)	0 (0.0)	0 (0.0)	0 (0.0)	2 (3.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Others	2 (1.1)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.6)
Shoulder/clavicle	**14 (7.7)**	**1 (1.9)**	**0 (0.0)**	**0 (0.0)**	**10 (16.7)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**1 (20.0)**	**2 (5.1)**
Articular	3 (1.7)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (5.1)
Bone	3 (1.7)	0 (0.0)	0 (0.0)	0 (0.0)	3 (5.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Ligament	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Muscle	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (20.0)	0 (0.0)
Skin	6 (3.3)	1 (1.9)	0 (0.0)	0 (0.0)	5 (8.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Upper arm and forearm	**5 (2.8)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**2 (3.3)**	**0 (0.0)**	**1 (14.3)**	**1 (33.3)**	**0 (0.0)**	**1 (2.6)**
Muscle	2 (1.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (14.3)	1 (33.3)	0 (0.0)	0 (0.0)
Skin	3 (1.7)	0 (0.0)	0 (0.0)	0 (0.0)	2 (3.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.6)
Elbow	**10 (5.5)**	**0 (0.0)**	**1 (11.1)**	**0 (0.0)**	**4 (6.7)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**1 (20.0)**	**4 (10.3)**
Ligament	2 (1.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (5.1)
Skin	8 (4.4)	0 (0.0)	1 (11.1)	0 (0.0)	4 (6.7)	0 (0.0)	0 (0.0)	0 (0.0)	1 (20.0)	2 (5.1)
Hand	**15 (8.3)**	**3 (5.6)**	**3 (33.3)**	**0 (0.0)**	**3 (5.0)**	**0 (0.0)**	**0 (0.0)**	**1 (33.3)**	**2 (40.0)**	**3 (7.7)**
Bone	2 (1.1)	0 (0.0)	1 (11.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (20.0)	0 (0.0)
Ligament	3 (1.7)	1 (1.9)	2 (22.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Skin	10 (5.5)	2 (3.7)	0 (0.0)	0 (0.0)	3 (5.0)	0 (0.0)	0 (0.0)	1 (33.3)	1 (20.0)	3 (7.7)
Lumbar spine	**9 (5.0)**	**4 (7.4)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**5 (71.4)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**
Articular	1 (0.6)	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

Continued

Table 4 Continued

	Total	Athletics	Beach volleyball	Canoe sprint	Cycling	Gymnastics	Rowing	Sport climbing	Table tennis	Triathlon
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Muscle	5 (2.8)	2 (3.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (42.9)	0 (0.0)	0 (0.0)	0 (0.0)
Others	3 (1.7)	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (28.6)	0 (0.0)	0 (0.0)	0 (0.0)
Pelvis/sacrum/buttock/hip/groin	**19 (10.5)**	**4 (7.4)**	**0 (0.0)**	**0 (0.0)**	**13 (21.7)**	**0 (0.0)**	**1 (14.3)**	**0 (0.0)**	**0 (0.0)**	**1 (2.6)**
Articular	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (14.3)	0 (0.0)	0 (0.0)	0 (0.0)
Concussion	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Muscle	2 (1.1)	2 (3.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Tendon	2 (1.1)	2 (3.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Skin	13 (7.2)	0 (0.0)	0 (0.0)	0 (0.0)	12 (20.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.6)
Thigh anterior	**5 (2.8)**	**2 (3.7)**	**0 (0.0)**	**0 (0.0)**	**2 (3.3)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**1 (2.6)**
Muscle	2 (1.1)	1 (1.9)	0 (0.0)	0 (0.0)	1 (1.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Skin	3 (1.7)	1 (1.9)	0 (0.0)	0 (0.0)	1 (1.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.6)
Thigh posterior	**18 (9.9)**	**17 (31.5)**	**1 (11.1)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**
Muscle	17 (9.4)	16 (29.6)	1 (11.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Others	1 (0.6)	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Knee	**23 (12.7)**	**8 (14.8)**	**1 (11.1)**	**0 (0.0)**	**10 (16.7)**	**1 (25.0)**	**0 (0.0)**	**1 (33.3)**	**0 (0.0)**	**2 (5.1)**
Articular	3 (1.7)	2 (3.7)	1 (11.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Ligament	4 (2.2)	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	1 (25.0)	0 (0.0)	1 (33.3)	0 (0.0)	1 (2.6)
Muscle	1 (0.6)	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Tendon	1 (0.6)	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Skin	14 (7.7)	3 (5.6)	0 (0.0)	0 (0.0)	10 (16.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.6)
Lower leg	**5 (2.8)**	**5 (9.3)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**
Muscle	1 (0.6)	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Skin	4 (2.2)	4 (7.4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Achilles tendon	**1 (0.6)**	**1 (1.9)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**
Tendon	1 (0.6)	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Ankle	**12 (6.6)**	**6 (11.1)**	**1 (11.1)**	**0 (0.0)**	**0 (0.0)**	**2 (50.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**3 (7.7)**
Articular	3 (1.7)	3 (5.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Bone	1 (0.6)	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Ligament	8 (4.4)	2 (3.7)	1 (11.1)	0 (0.0)	0 (0.0)	2 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (7.7)
Foot	**21 (11.6)**	**1 (1.9)**	**1 (11.1)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**19 (48.7)**
Ligament	1 (0.6)	0 (0.0)	1 (11.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Skin	19 (10.5)	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	18 (46.2)
Others	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.6)

Table 5 Characteristics of in-competition illnesses (numbers (percentage (%)) for affected system, cause and severity, as well as their distribution according to sports, during the 2022 European Championships in Munich

	Total	Athletics	Beach volleyball	Canoe sprint	Cycling	Gymnastics	Rowing	Sport climbing	Table tennis	Triathlon
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Total	65 (100.0)	41 (100.0)	1 (100.0)	2 (100.0)	4 (100.0)	0	17 (100.0)	0	0	0
Affected system										
Cardiovascular	16 (24.6)	6 (14.6)	0 (0.0)	1 (50.0)	0 (0.0)	0	9 (52.9)	0	0	0
Gastrointestinal	12 (18.5)	8 (19.5)	0 (0.0)	0 (0.0)	1 (25.0)	0	3 (17.6)	0	0	0
Lower respiratory tract (trachea, bronchi, lungs)	4 (6.2)	3 (7.3)	0 (0.0)	0 (0.0)	1 (25.0)	0	0 (0.0)	0	0	0
Upper respiratory tract (nose, sinuses, pharynx, larynx)	11 (16.9)	6 (14.6)	0 (0.0)	0 (0.0)	1 (25.0)	0	4 (23.5)	0	0	0
Urogenital, gynaecological or reproductive	2 (3.1)	1 (2.4)	0 (0.0)	0 (0.0)	0 (0.0)	0	1 (5.9)	0	0	0
Endocrine or metabolic	4 (6.2)	3 (7.3)	0 (0.0)	0 (0.0)	1 (25.0)	0	0 (0.0)	0	0	0
'Blood' (haematologic or immune)	1 (1.5)	1 (2.4)	0 (0.0)	0 (0.0)	0 (0.0)	0	0 (0.0)	0	0	0
Dermatologic/skin	3 (4.6)	2 (4.9)	0 (0.0)	1 (50.0)	0 (0.0)	0	0 (0.0)	0	0	0
Musculoskeletal	5 (7.7)	5 (12.2)	0 (0.0)	0 (0.0)	0 (0.0)	0	0 (0.0)	0	0	0
Neurologic, CNS	1 (1.5)	1 (2.4)	0 (0.0)	0 (0.0)	0 (0.0)	0	0 (0.0)	0	0	0
Ophthalmological/otological	1 (1.5)	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	0	0 (0.0)	0	0	0
Other	5 (7.7)	5 (12.2)	0 (0.0)	0 (0.0)	0 (0.0)	0	0 (0.0)	0	0	0
Cause										
Pre-existing disease (exacerbations of allergy, asthma, diabetes, degenerative, systemic inflammatory disorders, congenital, etc)	3 (4.6)	3 (7.3)	0 (0.0)	0 (0.0)	0 (0.0)	0	0 (0.0)	0	0	0
Infectious (viral, bacterial, fungal…)	20 (30.8)	13 (31.7)	0 (0.0)	0 (0.0)	0 (0.0)	0	7 (41.2)	0	0	0
Exercise related (dehydration, exhaustion…)	24 (36.9)	14 (34.1)	0 (0.0)	1 (50.0)	0 (0.0)	0	9 (52.9)	0	0	0
Nutritional, endocrine or metabolic disturbance	6 (9.2)	5 (12.2)	0 (0.0)	0 (0.0)	1 (25.0)	0	0 (0.0)	0	0	0
Environmental (heat, cold, altitude…)	5 (7.7)	3 (7.3)	1 (100.0)	1 (50.0)	0 (0.0)	0	0 (0.0)	0	0	0
Other/idiopathic	7 (10.8)	3 (7.3)	0 (0.0)	0 (0.0)	3 (75.0)	0	1 (5.9)	0	0	0
Severity										
No time loss	33 (50.8)	23 (56.1)	1 (100.0)	1 (50.0)	4 (100.0)	0	4 (23.5)	0	0	0
Time loss from 1 to 7 days	28 (43.1)	14 (34.1)	0 (0.0)	1 (50.0)	0 (0.0)	0	13 (76.5)	0	0	0
Time loss from 8 to 28 days	4 (6.2)	4 (9.8)	0 (0.0)	0 (0.0)	0 (0.0)	0	0 (0.0)	0	0	0
Time loss >28 days	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0	0 (0.0)	0	0	0

surveillance during the 2022 European Championships, which is a new continental multievents championship, similar to what has been done as a routine in Summer Olympic Games,[1–4 11] Winter Olympic Games[12–14] or European Athletics Championships.[10 17] Now that we developed the methods and implemented them during the 2022 European Championships, we hope that this can also be conducted as a routine for future editions of the European Championships.

The present results may be of great help for the organisation of the next European Championships. However, given the low national medical teams' coverage and response rates caution should be taken in the interpretation of the present results. During the last Summer Olympic Games, Soligard *et al*[4] reported an overall in-competition injury incidence of 53.2 per 1000 registered athletes: 50.8 in athletics, 52.1 in beach volleyball, 4.0 in canoe sprint, 37.3 in cycling, 56.1 in artistic gymnastics, 7.7 in rowing, 50.0 in sport climbing, 28.7 in table tennis and 108.1 in triathlon. Our results were lower for gymnastics and table tennis. For gymnastics, the incidence was also lower than during the 2008, 2012 and 2019 Olympic Games,[28] as well as during the elite male artistic USA gymnastics competition from 2008 to 2018.[29] These incidences can be underestimated by the low national medical teams' participation. Incidences were almost similar for beach volleyball and rowing, while low national medical teams' participation, the LOC physicians may have captured all injuries, or the injury rates were higher than during the Olympic Games. We reported higher injury incidences during the European Championships than Olympic Games[4] for cycling and triathlon despite very low national medical teams' participation. These results should be highlighted as they show a potential important injury risk in these sports. Their medical teams should be informed, and deeper exploration should be done to understand how to reduce this risk. For athletics, our results were also lower, and lower than during other international athletics championships using the same data collection methods,[10] but the national medical teams' participation was excellent. Other aspects could explain this lower incidence, for instance, less disturbance due to travel and lower duration of the championships compared with Olympic Games, or efficacy of injury prevention strategies.[30] Otherwise, as during Summer Olympic Games,[1–4 11] we used the number of registered athletes as exposure for injuries. However, since 1 hour of triathlon is probably not comparable to 1 hour of gymnastics, it would be relevant for future studies to capture more accurate exposure, such as for example duration in minutes.

For illnesses, Soligard *et al*[4] reported an overall illness incidence of 38.7 per 1000 registered athletes during the last Summer Olympic Games: 71.6 in athletics, 41.7 in beach volleyball, 40.3 in canoe sprint, 13.1 in cycling, 20.4 in artistic gymnastics, 30.7 in rowing, 25.0 in sport climbing, 63.2 in table tennis and 72.1 in triathlon. Our results are much lower, which can of course be explained by the low national medial teams' participation, but also the lower absolute number of registered athletes and the lower duration than during Olympic Games decreasing the potential contamination of infectious disease.[17] In addition, the European climate in comparison to that in Tokyo, especially for heat illnesses,[31] the continental event with less travel, and nutritional and cultural differences could be additional explanation of the differences in illness incidences.[17 32] Furthermore, illness prevention awareness could have been higher due to the implemented measures against COVID-19 in the preceding years as seen in other sports.[33]

We have to acknowledge some limitations. Although we followed the usual procedure to inform the LOC and national medical teams about the study, the national medical teams' participation (ranged from 8.3% to 93.4% according to sports) and response rates (ranged from 28.6% to 100.0% according to sports) were very low, without any coverage of athletes and responses by national medical teams in 5 sports. We do not know the reasons for the non-participation of the medical teams. This low medical teams' participation can be explained by the fact that such injury and illness surveillance is new in some sports, compared with athletics, in which this has been performed as a routine since 2009 during outdoor and indoor European Athletics Championships,[10 17] and for which the athletes' coverage in the 2022 European Athletics Championships was high (93.4%) as well as the response rate (100%). In addition, as for the preparticipation health questionnaire study,[23] other hypotheses for explanation could be that national medical teams were already focused and busy with their athletes, did not see any interest in the surveillance study, or did not have internet access. They could also have considered that the procedure for data collection was too long and time-consuming. There could also be a language barrier since the report form was only available in English. Or the fact that the Munich 2022 European Championships was a novel big event with a lot of communications and events at the same time which can have diluted this study into the mass.[23] Thus, the results should be interpreted with caution as well as its generalisation. This study was descriptive only, and we did not perform any comparisons between groups. We also have to acknowledge some weaknesses in the equity, diversity and inclusion approach. Apart from sex, no other characteristics were collected from the participants and were thus considered in the interpretation of results.

Given the mentioned limitations, there is a high need to continue injury and illness surveillance studies in future European Championships. The present methods can be used, as these are the methods successfully used for injury and illness in European Athletics Championships.[10 17] For that, there will be a need to better prepare it by better involving the national federations and national medical teams in the project, by informing them a longer time before, educating them about the interest of such a study, asking them about their need and how to improve

their adherence, and providing them with more feedback so that they may have more interest in participating in such study. We also can improve access to the internet, translate the injury and illness surveillance documents into different languages to avoid the language barrier and coordinate with other potential research projects within the same big event to limit the risk of diluting the study into the masses.

Based on the current results, we have to highlight the high injury risk in triathlon and cycling and do not neglect this risk in athletics and beach volleyball. Medical services for the next European Championships or the next triathlon and cycling championships should be aware of this risk. And teams preparing triathlon and cycling athletes should continue efforts to reduce this injury risk by focusing on the most reported injuries.

CONCLUSIONS

This was the first injury and illness surveillance during the European Championships providing relevant results to help anticipate medical services and athletes' health protection. Special attention should be given to triathlon and cycling given their high injury risk. There is a high need to continue such injury and illness surveillance in future European Championships.

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