

Injury Risk Reduction Perceptions in Athletics: Survey on Elite Athletes and Stakeholders Participating at the Munich 2022 European Championships

Wahrnehmungen zur Reduktion von Verletzungsrisiken in der Leichtathletik: Umfrage unter Elite-Athleten und Beteiligten der Europameisterschaften 2022 in München

Summary

- › **Problem:** We aimed to explore the perceptions and behaviours of athletics (track and field) stakeholders towards injury risk reduction.
- › **Methods:** We conducted a cross-sectional study in athletes, coaches, health professionals and team leaders registered for athletics at the 2022 European Athletics championships in Munich (Germany), using an online questionnaire asking about their perceptions and behaviours towards injury risk reduction scored with a scale from disagree-0 to agree-100.
- › **Results:** There were 71 participants (2.9%): 30 athletes, 10 coaches, 28 health professionals and 3 team leaders from 16 countries. In general, they were very likely to agree that injury is part of the sport (mean±SD) 80±22), injury risk should be taken into account for life choices (75±23), while less likely to think that risking injury is not totally necessary to achieve peak performance (53±32). Most of them were likely to adopt injury risk reduction strategies in their daily life/practice (82±19), warm-up, hydration, and listening to pain were the most frequently adopted/suggested strategies, while digestive naps, psychological support, and mental preparation being the less likely.
- › **Conclusions:** These results provide a clear and relevant orientation to improve and develop injury risk reduction measures/strategies and their adoption and implementation.

KEY WORDS:

Sports Injury Prevention, Behaviors, Interactions, Online-Survey

Zusammenfassung

- › **Problem:** Unser Ziel war es, die Wahrnehmungen und Verhaltensweisen von Akteuren im Leichtathletiksport im Hinblick auf die Reduktion des Verletzungsrisikos zu untersuchen.
- › **Methoden:** Wir führten eine Querschnittsstudie mit Sportlern, Trainern, medizinischem Fachpersonal und sportlichen Leitungen durch, die für die Leichtathletik bei den Leichtathletik-Europameisterschaften 2022 in München (Deutschland) registriert waren. Dazu wurde ein Online-Fragebogen genutzt, in dem wir nach ihren Einstellungen und Verhaltensweisen in Bezug auf die Reduzierung des Verletzungsrisikos gefragt wurden, gemessen mittels einer Skala von „stimme nicht zu – 0“ bis „stimme zu – 100“.
- › **Ergebnisse:** Es gab 71 Teilnehmer (2.9%): 30 Athleten, 10 Trainer, 28 medizinisches Fachpersonal und 3 sportliche Leiter aus 16 Ländern. Im Allgemeinen stimmten sie sehr wahrscheinlich zu, dass Verletzungen Teil des Sports sind (Mittelwert±Standardabweichung 80±22), dass das Verletzungsrisiko bei Lebensentscheidungen berücksichtigt werden sollte (75±23). Seltenere waren sie der Meinung, dass das Risiko einer Verletzung nicht unbedingt notwendig ist, um Spitzenleistungen zu erzielen (53±32). Die meisten wendeten Strategien zur Reduzierung des Verletzungsrisikos in ihrem täglichen Leben/praktische Tätigkeit an (82±19). Aufwärmen, adäquate Flüssigkeitszufuhr und das Hören auf den Schmerz waren die am häufigsten angewandten/vorgeschlagenen Strategien, während Mittagsschlaf, psychologische Unterstützung und mentale Vorbereitungen am seltensten vorkamen.
- › **Schlussfolgerungen:** Diese Ergebnisse bieten eine klare und sachdienliche Orientierung für die Verbesserung und Entwicklung von Maßnahmen/Strategien zur Reduktion des Verletzungsrisikos sowie deren Annahme und Umsetzung.

SCHLÜSSELWÖRTER:

Prävention von Sportverletzungen, Verhaltensweisen, Interaktionen, Online-Fragebogen

Introduction

Athletics (track and field) is associated with a risk of injuries (i.e., about two-thirds of athletes had an injury every season), emphasizing injury prevention/injury risk reduction approaches to allow healthy and sustainable athletics activity (5). By such, injury risk reduction seems logical and relevant. This has been underlined by a survey on 2864 French athletes, coaches and health professionals reporting that 98% of

the participants perceived that injury risk reduction in athletics was relevant (16). It would be now of interest to explore if these results are similar in an international population of elite athletes, coaches and health professionals participating in international athletics competitions. In such a population, the exposure to injury risk is high (10, 11) given the high training volume and/or intensity as well as the

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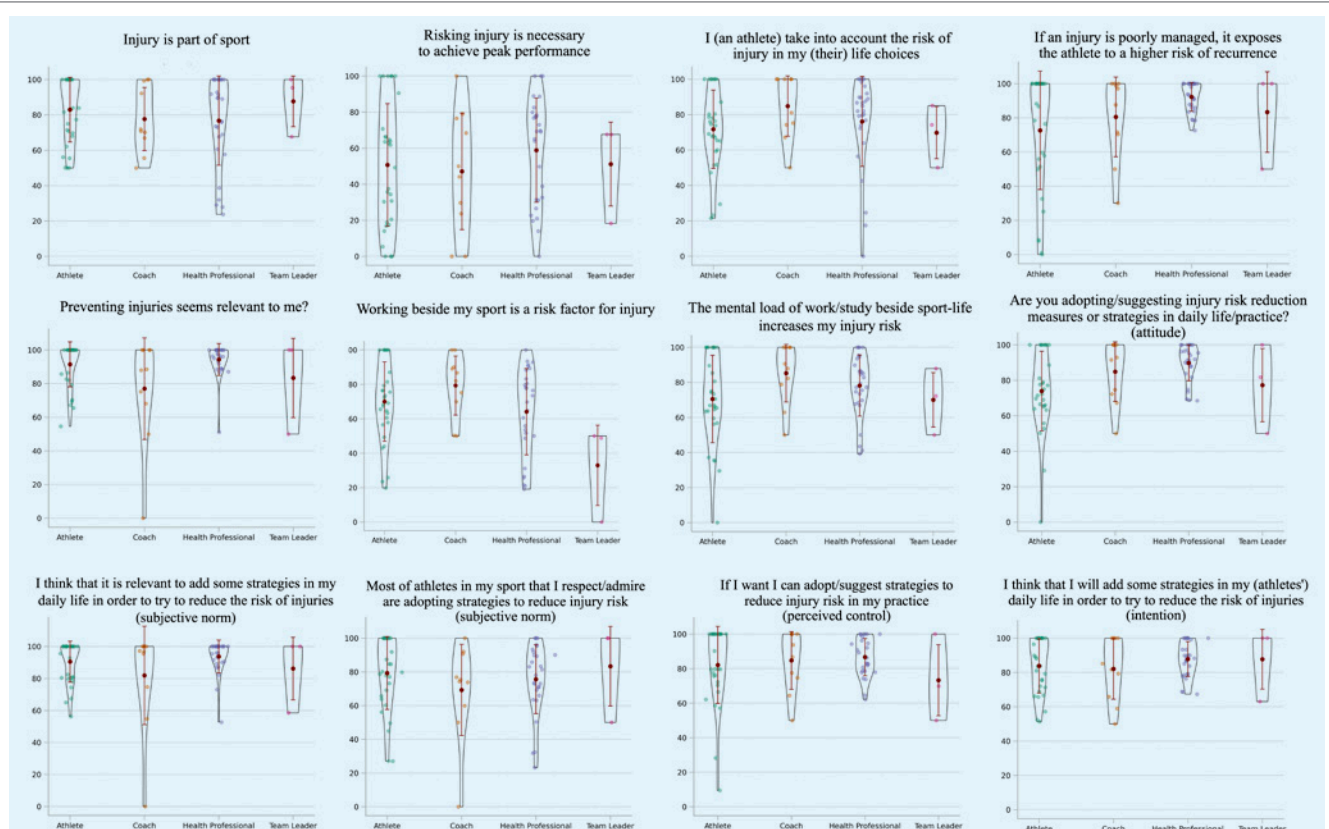


Figure 1

Perception about general statements towards injuries and injury prevention / injury risk reduction of athletes, coaches, health professionals and team leaders. Individuals are represented by single points. Probability density curve is shown by black lines. Medians are represented through red points. #: significant difference between two groups ($p < 0.05$).

regular competitions (13, 33), and these injuries are having a direct consequences on the athletes' activities including sports (12, 15, 17, 27).

Although injury risk reduction seems logical and relevant, and even if this opinion is shared by the athletics stakeholders (16), injury risk reduction approaches are seldomly adopted (17, 29). In a recent online survey on 7715 athletes, less than one-third of athletes self-declared having partially or fully adopted any injury risk reduction program during their lifetime (An injury risk reduction program was defined in the survey as a set of specific exercises related to the sport which aims to reduce the risk of injury, including, for example, muscle strengthening, stretching or balance exercises) (29). Hence, only 9% of the athletes from the intervention group and included in the analysis declared to have fully complied with the injury risk reduction intervention in a recent cluster-randomized controlled trial in athletics (17). These results support the fact that injury risk reduction approaches are poorly adopted in athletics (6,17, 26), similarly to other sports (28).

Improving the adoption of injury risk reduction approaches thus represents an important challenge (4, 7). And a better understanding of the perceptions and beliefs towards injury risk reduction can be a strategy in this goal (4, 7), especially for elite athletes and stakeholders participating in international athletics competitions. In addition, it could be interesting to have a more precise view of their behaviours on injury risk reduction measures and strategies, by not only questioning global injury risk reduction approaches, but more specifically on elements, exercises, and domains of preventative behaviours.

In this context, the aim of this study was to explore the perceptions and behaviours of athletics athletes, coaches, health professionals and team leaders towards injury risk reduction.

Methods

Study Design, Overall Procedure and Population

We conducted a cross-sectional study in athletes, coaches, health professionals and team leaders registered at the 2022 European Athletics championships from the 15th to the 21st of August 2022 in Munich (Germany), using an online questionnaire asking about their perceptions and behaviours towards injury risk reduction. Participants were included if they completed the questionnaire. As it was an exploratory study, no sample size was calculated a priori.

All data were collected anonymously so that no individual participant could be directly identified. The study was reviewed and approved by the Saint-Etienne University Hospital Ethical Committee (Institutional Review Board: IORG0007394; IRBN792022/CHUSTE). All participants were informed about the study aim and procedure and that their data were used for research as well as about their rights to refuse that their data are used for research. No signed informed consent was required by the Ethical Committee.

Data Collection Procedure

One month before the 2022 European Athletics championships in Munich, the research team sent an e-mail to the European Athletics, asking to forward it to their member Federations, with the final aim to forward it to their athletes, coaches, health professionals and team leaders registered at the 2022 European Athletics championships (9). In addition, this email was also sent by the medical and anti-doping commission of the European Athletics to the health professionals registered at the 2022 European Athletics championships, asking them to participate

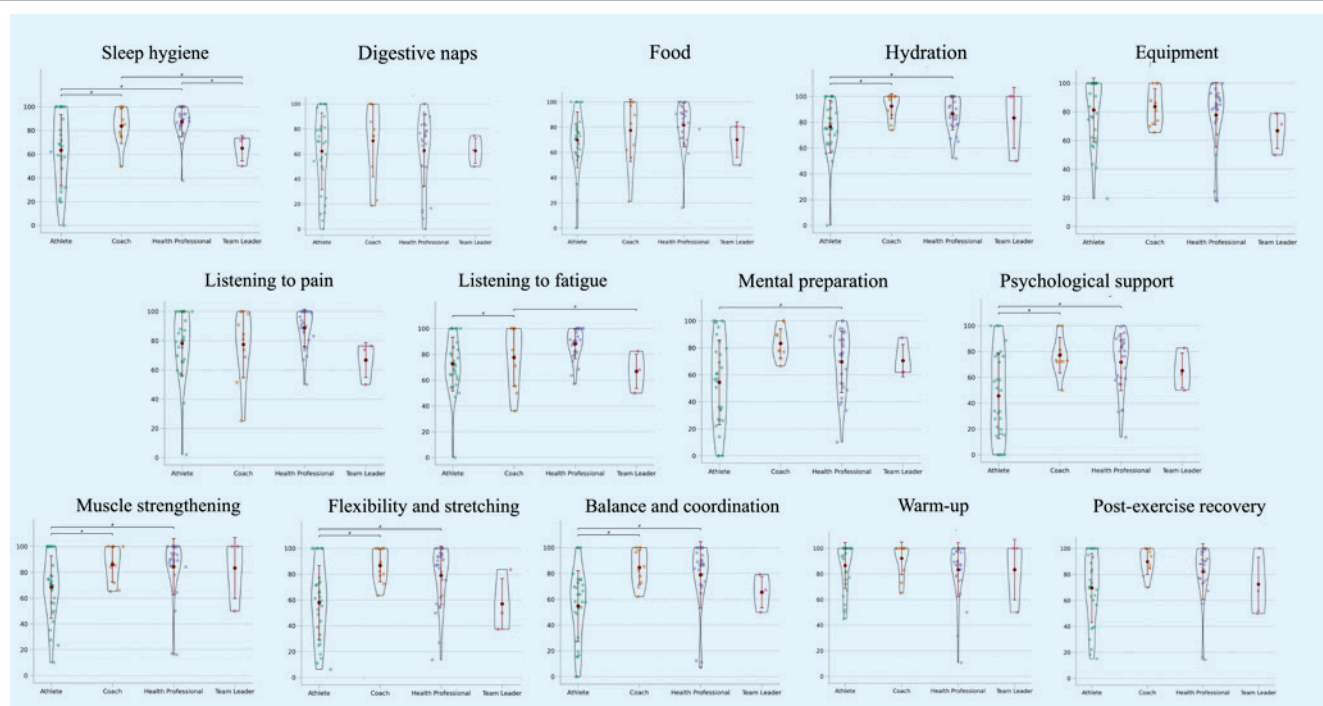


Figure 2

Injury risk reduction behaviours of athletes, coaches, health professionals and team leaders. Individuals are represented by single points. Probability density curve is shown by black lines. Medians are represented through red points. #: significant difference between two groups ($p < 0.05$).

in this study and encourage athletes, coaches and team leaders of their team to participate in this study (9).

At the start of the 2022 European Athletics championships, during the European Athletics medical meeting, the research team encouraged medical staff to participate in this study and to complete the questionnaire as well as to encourage their athletes, coaches and team leaders to participate in this study (9).

During the championship period, athletes, coaches, health professionals and team leaders registered at the championships were informed about the present study and were asked to complete the questionnaire by i) poster displayed on the different venues of the championships (hotels, restaurants, medical centres, training area, warm-up areas, athletes lounges, accreditation centre, bus, toilets), ii) a flyer given to each athlete with the accreditation, iii) emails sent by their national federations, iv) volunteers at the different venues during the whole period of the championships and informing the athletes about the present study, to arouse interest in participating in the study and how to participate (9).

Participants were thus invited to complete the questionnaire on i) personal characteristics (sex, age, country, role) and ii) their perceptions and behaviours towards injury risk reduction (supplementary material questionnaire online). The questionnaire's part on perceptions and behaviours towards injury risk reduction included three sub-parts: 1) thirteen questions on their perceptions about general statements towards injuries and injury risk reduction to be replied using a continuous scale from disagree-0 to agree-100 (31); 2) fourteen questions asking how often they performed some specific injury risk reduction approaches in their daily life/practice to be replied using a continuous scale from never-0 to always-100 (31); and 3) one question about the importance of the relationships between stakeholders (athlete, coach, health professional, team leader, family, social life and work) for the injury risk management / reduction using a continuous scale from no importance-0 to extremely important-100 (31) (supplementary material questionnaire

online). Among the questions on their perceptions about general statements towards injury risk reduction, there were four questions measuring their beliefs (attitudes, subjective norms, perceived behavioural control, and intentions) from the theory of planned behaviour inspired by Fishbein and Ajzen (18). For the 14 questions about injury risk reduction behaviours, participants were asked about domains/measures/strategies that have been reported as relevant to reduce the injury risk in athletics and sports in general (5, 19, 23, 29, 30, 32): sleep hygiene, digestive naps, food, hydration, equipment, listening to pain, listening to fatigue, warm-up, recovery, muscle strengthening, stretching, balance, mental preparation, and psychological support. The wording of the questions slightly differed between the athletes and the coaches, health professionals and team leaders, to be appropriate to the targeted population. The questionnaire was developed by the co-authors to reply to the study aim and there was no analysis of validity and reliability of the questionnaire. The questionnaire was available only in English and in an online format using a website application names IPrevApp through a QR code. Participants were asked to complete the questionnaire themselves or, if needed seek the help of team physicians or the study team at the venues.

Statistical Analyses

First, we performed descriptive analyses using frequency and percentages for categorical data, and means and standard deviations (SD) for continuous variables. Then, we explored potential significant statistical differences in the values between athletes, coaches, health professionals, and team leaders, by using a Kruskal-Wallis (non-parametric) test, followed by a Mann-Whitney pairwise comparison test. We finally performed a social network analysis representation on the stakeholder relationships regarding injury risk management and reduction (25).

Statistical analyses were conducted utilizing Python version 3.10.2 as provided by the Python Software Foundation, data processing was performed using the pandas package >

Table 1

Characteristics of the 71 included participants.

	TOTAL	ATHLETE	COACH	HEALTH PROFESSIONAL	TEAM LEADER
Numbers of participants (n (%))					
Total	71 (100.0)	30 (42.3)	10 (14.1)	28 (39.4)	3 (4.2)
Female	26 (36.6)	14 (19.7)	3 (4.2)	9 (12.7)	-
Male	45 (63.4)	16 (22.5)	7 (9.9)	19 (26.8)	3 (4.2)
Number of countries (n)					
Total	16	5	2	15	3
Female	16	5	2	7	0
Male	16	5	2	10	3
Age (mean (SD))					
Total	39.1 (15.9)	26.6 (5.1)	53.8 (8.5)	47.0 (16.2)	42.8 (16.9)
Female	37.0 (14.4)	26.2 (4.4)	55.0 (7.5)	47.9 (11.9)	-
Male	40.4 (16.7)	26.9 (5.7)	53.3 (9.4)	46.5 (18.2)	42.8 (16.9)

version 1.5.1), and the Scipy package version 1.9.3 was used for conducting statistical analyses. Significance was accepted at $p < 0.05$. Social networks graphs were created using pyvis 0.1.3.1.

Results

Population

A total of 1540 athletes, 705 coaches, 165 health professionals and 35 team leaders, from 48 countries were registered at the 2022 European Athletics championships. Among them, 71 (2.9%) participants from 16 (33.3%) countries participated in the present study: 30 (1.9%) athletes, 10 (1.4%) coaches, 28 (17.0%) health professionals and 3 (8.6%) team leaders (Table 1).

Perceptions about General Statements towards Injuries and Injury Risk Reduction

In general, participants were most likely to perceive that injury is part of the sport ((mean) $80 \pm (SD) 22$), injury risk should be taken into account for life choice (75 ± 23), poorly managed injuries expose to re-injury (82 ± 27), preventing injuries seems relevant (90 ± 17), and most of them were adopting injury risk reduction measures or strategies in their daily life/practice (82 ± 19) (figure 1 and supplementary table 2 online). They were however less likely to perceive that risking injury is necessary to achieve peak performance (53 ± 32) (figure 1 and supplementary table 2 online). All stakeholders reported positive beliefs (attitudes, subjective norms, perceived behavioural control and intentions) towards injury risk reduction approaches, without significant differences between stakeholders (figure 1 and supplementary table 2 online).

Injury Risk Reduction Behaviour

Warm-up, hydration, and "listening to pain" were the most frequently adopted/suggested strategies, while digestive naps, psychological support, and mental preparation were less frequently adopted/suggested (figure 2 and supplementary table 3 online). There were significant differences between stakeholders for sleep hygiene, hydration, listening to fatigue, muscle strengthening, flexibility/stretching, balance/coordination, mental preparation and psychological support, with athletes being less likely to adopt the measures/strategies than coaches and/or health professionals (figure 2 and supplementary table 3 online).

Relationships Between Stakeholders

When averaging all answers of all stakeholders (figure 3-a and supplementary table 4 online), we could observe an athlete-health professionals-coaches clique appear, with significantly higher relationship importance. Relationships between health professionals-coaches-team leaders also form a noticeable clique. We equally note that the athlete-family relationship is relatively important. When averaging answers from the athletes only (figure 3-b and supplementary table 4 online), the two preceding cliques are also observed, but we observe that from the athlete's point of view, family and social life have greater importance. This vision is shared by the coaches (figure 3-c and supplementary table 4 online), even if they also considered the work-athlete relationship equally important. The vision of the health professionals (figure 3-d and supplementary table 4 online) is to put the athlete at the centre of the process (25); the two main cliques are the athlete-health professionals-coaches clique and the athlete-health professionals-family clique. The relationships between the athlete and his work, and the athlete and his social life, are also highlighted. Finally, the vision of team leaders (figure 3-e and supplementary table 4 online) shows all three cliques mentioned above, showing a rather dense network of relationships.

Discussion

The main findings of the present study were that 1) athletes, coaches, health professionals and team leaders participating at the 2022 European Athletics championships and in this study perceived that i) injury is part of the sport, ii) preventing injuries is relevant, and iii) they were very likely to adopt injury risk reduction measures or strategies, without significant differences in these perceptions between stakeholders, 2) they showed positive beliefs, and 3) some injury risk reduction behaviours were the most frequently adopted/suggested (e.g., warm-up, hydration, and "listening to pain") with variations between the stakeholders, especially athletes being often less likely to adopt the measures/strategies than coaches and/or health professionals.

Injury is Part of the Athletics

Previous studies reporting epidemiological data highlighted the high prevalence and burden of injuries in athletics (3, 5, 8, 10, 11, 13, 20, 24, 33). Epidemiological studies in elite athletes

during athletics international championships highlight the high injury rates (10, 11, 13). Other studies during a longer period of time also reported an important proportion of injured athletes and/or high injury risk (3, 17, 20, 24). Thus, injuries appear to be part of athletics, as in other sports as well (1). Recent qualitative studies reported, through interviews of athletes and health professionals, that injuries take an important place in the athlete's career (1, 2). The present study represents an additional piece as it reports the perceptions of athletes, coaches, health professionals and team leaders, which matches results of previous studies, that injury is part of the sport. Therefore, injury risk reduction strategies should be developed and adequately implemented to try to reduce this risk.

Risking Injury Seems not the Only Way to Reach Success

Although stakeholders were very likely to perceive that injury is part of the sport, they also were likely to perceive that risking an injury is not necessary to achieve peak performance. This can be interpreted that the body can perform at best without injury and that athletics can be performed by maintaining healthy condition. This could be what stakeholders are doing or had as a goal. We also think that high-level practice should be done by respecting the body. This does not only mean that there is a need to be healthy to perform at best (12,15,27), but also and more importantly, that there is maybe no need to harass/hurt the body to perform at best.

Theoretically a Fertile Ground for Injury Risk Reduction Implementation

Athletes participating in this study declared that they were likely adopting injury risk reduction measures or strategies: the mean score regarding injury risk reduction measures or strategies was 74% for athletes. In addition, about one-third (27%) reported a score of 100% meaning that they were always adopting injury risk reduction measures or strategies. These scores were higher than in a population of French athletes of all levels reporting that less than one-third of athletes declared having partially or fully adopted an injury risk reduction program during their lifetime (29). This can be explained by the high level of athletics practice in the current study; athletes could aim to put the maximum chance in their sporting project by trying at best to reduce injuries. Ruffault et al. (29) also reported that athletes with higher levels were more likely to adopt injury risk reduction approaches. Furthermore, there could be a selection bias to explain the higher adoption since i) only healthy and top-performing athletes took part in the European Championships, and ii) athletes and stakeholders convinced by injury risk reduction approach could have more likely replied to the questionnaire in comparison to others.

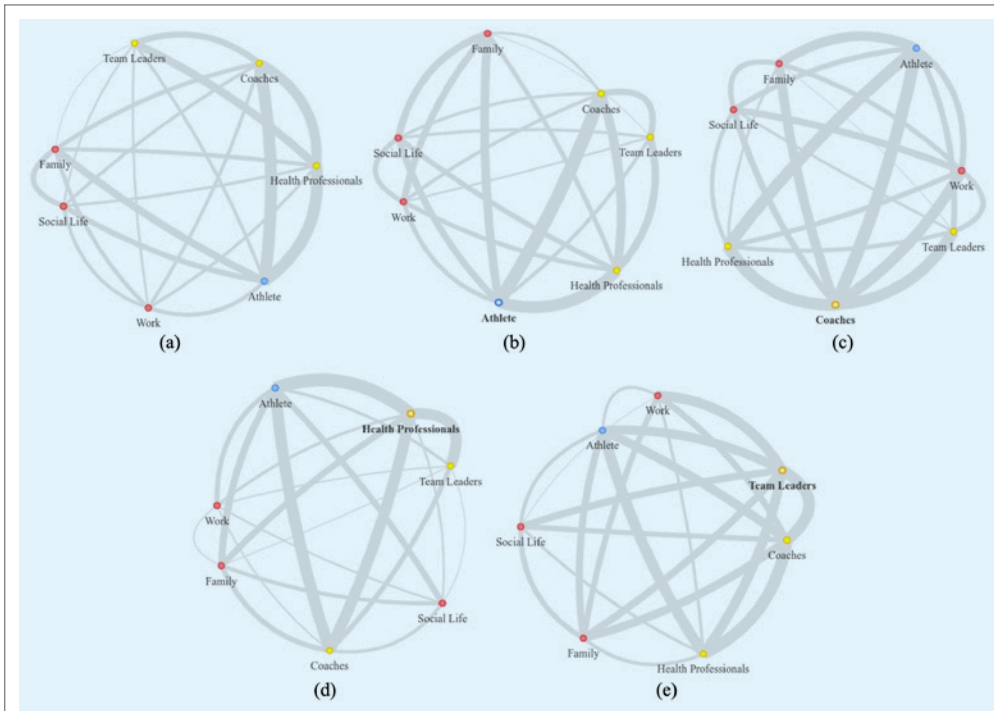


Figure 3

Social Networks graphs representing relative importance of relationships between stakeholders: a) when averaging all answers of all stakeholders, b) averaged answers from the athletes only, c) averaged answers from the coaches only, d) averaged answers from the health professionals, and e) averaged answers from the team leaders. Edge thicknesses are set proportionately to the values mentioned in supplementary table 4 online. Html versions of all graphs are given in supplementary figure 4 online.

Important Inter-Individual Differences in Injury Risk Reduction Behaviour

Our results reported an important inter-individual variability in the level of adoption/suggestion of the different behaviours between the participants. For almost all behaviours, the responses ranged from never-0 to always-100 (figure 2). This may be explained by the difference in age, experience, athletics discipline, culture, background, role, mission, or opinion between individuals. In addition, this can also be explained by the fact that, currently and to our knowledge, no high-level scientific studies specifically in athletics have supported with a high level of evidence the efficacy of these injury risk reduction measures/strategies and thus behaviours to reduce the risk of injuries. These measures/strategies are thus proposed based on evidence-based approaches combining evidence from other sports (e.g., strengthening (22, 23), proprioception (23), and psychological interventions (19)) and expert experience in athletics (5, 14). Without scientific-based evidence, it is thus difficult to support and impose them, explaining their low adoption and supporting the need to continue studies specifically in athletics.

Different Perceptions and Behaviours According to Stakeholders

Our results highlight some differences between the athletes, coaches, health professionals and team leaders in their perceptions/behaviours towards injury risk reduction approaches. This can be also explained by the different characteristics mentioned above for the inter-individual variation in behaviour. This result may help to improve injury risk reduction approaches and implementation. This highlights that there are probably different practices between stakeholders, and consequently there could have been some disagreement between them, which does not help for adoption and implementation of the measures/

strategies. Injury risk reduction approaches could thus be badly or not be performed if the athlete and their teams do not agree about the approach. As a perspective to improve that, we suggest i) improving scientific evidence to better support the injury risk reduction approaches, and more importantly ii) trying to understand why athletes and stakeholders do not do injury risk reduction approaches although they know that it is relevant (16). We need to find the hook that makes them adopting these approaches, such as for instant, putting performance at the center of the discussions: adopting injury risk reduction approach to be stronger and to improve performance. In addition, there would be a need for education (7) of all stakeholders about the injury risk reduction approach, so that all have the same level of knowledge. Given the inter-individual differences, there would also be a need to better individualise the preventative approach (7). And finally, there would also a need of communication between all stakeholders to define the injury risk reduction approach in order to have all the team on the same line (1, 2, 7).

Limitations

Although numerous strategies were implemented to disseminate information about this survey (e.g., emails to targeted participants through federations, information through medical staff, posters, flyers, social media, volunteers on site to present the study) (9), the sample of participants is small (n=71; 2.9%). Some hypotheses of explanation can be suggested, which also represent proposals for improvement: athletes and their teams were focused on their championships and did not want to participate in other activities, the survey could have been too long, the questionnaire was only available in English which could have limit the participation for not-English-speaking countries, some potential culturescape related bias could have influenced the participation of athletes (21), the Munich 2022 European Championships was a big event with a lot of communications and events at the same time which can have diluted the present study into the mass (9). Thus, the results should be interpreted with caution as well as its generalisation. In addition, this small participation could also be considered as a result, by pointing out the potential low interest of the targeted population in the topic of injury prevention/injury risk reduction, although given the injury risk in athletics it seems logical that injury risk reduction would be an important topic for athletes and their entourage. Statistical analyses should be interpreted with caution given the small sample size, and should be more considered to orient the reflection. It is important to consider the distribution of the values with a more descriptive approach. Then, we have to acknowledge some weaknesses in the equity, diversity and inclusion approach. Apart from gender, no other characteristics were collected from the participants and were thus considered in the analysis and interpretation of results. The author team

only included one woman. The questionnaire was developed by the co-authors to reply to the study aim and there was no analysis of validity and reliability of the questionnaire. The age was not included in the analyses.

Conclusions

The present study on a population of elite athletes, coaches, health professionals and team leaders participating at the 2022 European Athletics championships reported that injury is part of athletics, preventing injuries is relevant, and that they were very likely to adopt injury risk reduction measures or strategies. This indicates a high willingness and readiness of athletes and stakeholders to comply with preventive measures. Therefore, these results give leeway for further research aiming to identify possible non-athlete centered barriers limiting an effective injury prevention in athletics. Those may be, among others, regular medical care during training, education and financial independence. ■

Conflict of Interest

The authors have no conflict of interest.

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Competing Interest: None declared. PE is Associate Editor for the British Journal of Sports Medicine. KH is Editor for the German Journal of Sports Medicine. PE and KH are Associate Editors for the BMJ Open Sports and Exercise Medicine.

Ethics approval: The study was reviewed and approved by the Saint-Etienne University Hospital Ethical Committee (Institutional Review Board: IORG0007394, IRBN792022/CHUSTE).

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References

- (1) **BOLLING C, BARBOZA SD, VAN MECHELEN W, ROELINE PASMAN H.** Letting the cat out of the bag: Athletes, coaches and physiotherapists share their perspectives on injury prevention in elite sports. *Br J Sports Med.* 2020; 54: 871-877. doi:10.1136/bjsports-2019-100773
- (2) **BONELL MONSONÍS O, VERHAGEN E, KAUX JF, BOLLING C.** 'I always considered I needed injury prevention to become an elite athlete': the road to the Olympics from the athlete and staff perspective. *BMJ Open Sport Exerc Med.* 2021; 7: e001217. doi:10.1136/bmjsem-2021-001217
- (3) **CARRAGHER P, RANKIN A, EDOUARD P.** A One-Season Prospective Study of Illnesses, Acute, and Overuse Injuries in Elite Youth and Junior Track and Field Athletes. *Front Sport Act Living.* 2019; 1: 13. doi:10.3389/fspor.2019.00013
- (4) **DONALDSON A, LLOYD DG, GABBE BJ, COOK J, FINCH CF.** We have the Programme, what next? Planning the implementation of an injury prevention programme. *Inj Prev.* 2017; 23: 273-280. doi:10.1136/injuryprev-2015-041737

- (5) **EDOUARD P, ALONSO JM, JACOBSSON J, DEPIESSE F, BRANCO P, TIMPKA T.** Injury Prevention in Athletics: The Race Has Started and We Are on Track! *New Stud Athl.* 2015; 30: 69-78.
- (6) **EDOUARD P, BLANCO D, STEFFEN K, NIELSEN RO, VERHAGEN E, RUFFAULT A.** Which Athletes Fail Faster to Send Weekly Questionnaires or to Comply with an Injury Risk Reduction Program? *Dtsch Z Sportmed.* 2023; 74: 24-28. doi:10.5960/dzsm.2022.554
- (7) **EDOUARD P, CAUMEIL B, VERHAGEN E, GUILHEM G, RUFFAULT A.** Maximising individualisation of sports injury risk reduction approach to reach success. *Braz J Phys Ther.* 2022; 26: 100394. doi:10.1016/j.bjpt.2022.100394
- (8) **EDOUARD P, DANDRIEUX P-E, CHAPON J, PRINCE C, CHARPY S, BRUNEAU A, NAVARRO L, HOLLANDER K.** One-Season Epidemiology of Injury Complaints in Athletics (Track and Field). *Dtsch Z Sportmed.* 2022; 73: 215-220. doi:10.5960/dzsm.2022.544
- (9) **EDOUARD P, DANDRIEUX PE, HOLLANDER K, ZYSKOWSKI M.** Pre-Participation Injury and Illness Complaints of Elite Athletes Participating at the Munich 2022 European Championships. *Dtsch Z Sportmed.* 2023; 74: 40-46. doi:10.5960/dzsm.2023.559
- (10) **EDOUARD P, JUNGE A, ALONSO JM, TIMPKA T, BRANCO P, HOLLANDER K.** Having an injury complaint during the four weeks before an international athletics (track and field) championship more than doubles the risk of sustaining an injury during the respective championship: a cohort study on 1095 athletes during 7 international championships. *J Sci Med Sport.* 2022; 25: 986-994. doi:10.1016/j.jsams.2022.10.010
- (11) **EDOUARD P, NAVARRO L, BRANCO P, GREMEAUX V, TIMPKA T, JUNGE A.** Injury frequency and characteristics (location, type, cause and severity) differed significantly among athletics (, track and field) disciplines during 14 international championships (2007-2018): Implications for medical service planning. *Br J Sports Med.* 2020; 54: 159-167. doi:10.1136/bjsports-2019-100717
- (12) **EDOUARD P, NAVARRO L, PRUVOST J, BRANCO P, JUNGE A.** In-competition injuries and performance success in combined events during major international athletics championships. *J Sci Med Sport.* 2021; 24: 152-158. doi:10.1016/j.jsams.2020.07.011
- (13) **EDOUARD P, POLLOCK N, GUEX K, KELLY S, PRINCE C, NAVARRO L, BRANCO P, DEPIESSE F, GREMEAUX V, HOLLANDER K.** Hamstring Muscle Injuries and Hamstring Specific Training in Elite Athletics (Track and Field) Athletes. *Int J Environ Res Public Health.* 2022; 19: 10992. doi:10.3390/ijerph191710992
- (14) **EDOUARD P, RICHARDSON A, MURRAY A, DUNCAN J, GLOVER D, KISS M, DEPIESSE F, BRANCO P.** Ten Tips to Hurdle the Injuries and Illnesses During Major Athletics Championships: Practical Recommendations and Resources. *Front Sport Act Living.* 2019; 1. doi:10.3389/fspor.2019.00012
- (15) **EDOUARD P, RICHARDSON A, NAVARRO L, GREMEAUX V, BRANCO P, JUNGE A.** Relation of Team Size and Success With Injuries and Illnesses During Eight International Outdoor Athletics Championships. *Front Sports Act Living.* 2019; 1: 8. doi:10.3389/fspor.2019.00008
- (16) **EDOUARD P, RUFFAULT A, BOLLING C, NAVARRO L, MARTIN S, DEPIESSE F, OESTERGAARD NIELSEN R, VERHAGEN E.** French Athletics Stakeholders' Perceptions of Relevance and Expectations on Injury Prevention. *Int J Sports Med.* 2021; 43: 1052-1060. doi:10.1055/a-1843-6533
- (17) **EDOUARD P, STEFFEN K, PEURIERE M, GARDET P, NAVARRO L, BLANCO D.** Effect of an unsupervised exercises-based athletics injury prevention programme on injury complaints leading to participation restriction in athletics: A cluster-randomised controlled trial. *Int J Environ Res Public Health.* 2021; 18: 11334. doi:10.3390/ijerph182111334
- (18) **FISHBEIN M, AJZEN I.** Predicting Changing Behavior. New York; 2010.
- (19) **GLEDHILL A, FORSDYKE D, MURRAY E.** Psychological interventions used to reduce sports injuries: A systematic review of real-world effectiveness. *Br J Sports Med.* 2018; 52: 967-971. doi:10.1136/bjsports-2017-097694
- (20) **JACOBSSON J, TIMPKA T, KOWALSKI J, NILSSON S, EKBERG J, DAHLSTRÖM Ö, RENSTRÖM PA.** Injury patterns in Swedish elite athletics: annual incidence, injury types and risk factors. *Br J Sports Med.* 2013; 47: 941-952. doi:10.1136/bjsports-2012-091651
- (21) **KÖNIGSTEIN K, GATTERER K, WEBER K, SCHMIDT-TRUCKSÄSS A, TERCIER S, BLANK C.** Geographical heterogeneity of doping-related knowledge, beliefs and attitude among 533 Youth Olympics participants. *J Sci Med Sport.* 2021; 24: 1116-1122. doi:10.1016/j.jsams.2021.06.001
- (22) **LAUERSEN JB, ANDERSEN TE, ANDERSEN LB.** Strength training as superior, dose-dependent and safe prevention of acute and overuse sports injuries: A systematic review, qualitative analysis and meta-analysis. *Br J Sports Med.* 2018; 52: 1557-1563. doi:10.1136/bjsports-2018-099078
- (23) **LAUERSEN JB, BERTELSEN DM, ANDERSEN LB.** The effectiveness of exercise interventions to prevent sports injuries: A systematic review and meta-analysis of randomised controlled trials. *Br J Sports Med.* 2014; 48: 871-877. doi:10.1136/bjsports-2013-092538
- (24) **MARTÍNEZ-SILVÁN D, WIK EH, ALONSO JM, JEANGUYOT E, SALCINOVIC B, JOHNSON A, CARDINALE M.** Injury characteristics in male youth athletics: A five-season prospective study in a full-time sports academy. *Br J Sports Med.* 2021; 55: 954-960. doi:10.1136/bjsports-2020-102373
- (25) **NAVARRO L, DANDRIEUX PE, HOLLANDER K, EDOUARD P.** Digitalization in Professional Football: An Opportunity to Estimate Injury Risk. In: Collaborative Networks in Digitalization and Society 5.0: 23rd IFIP WG 5.5 Working Conference on Virtual Enterprises, PRO-VE 2022, Lisbon, Portugal, September 19-21, 2022. Springer International Publishing; 2022: 366-375. doi:10.1007/978-3-031-14844-6_30
- (26) **NIELSEN RO, BERTELSEN ML, RAMSKOV D, DAMSTED C, VERHAGEN E, BREDEWEG SW, THEISEN D, MALISOUX L.** Randomised controlled trials (RCTs) in sports injury research: authors-please report the compliance with the intervention. *Br J Sports Med.* 2020; 54: 51-57. doi:10.1136/bjsports-2019-100858
- (27) **RAYSMITH BP, DREW MK.** Performance success or failure is influenced by weeks lost to injury and illness in elite Australian track and field athletes: A 5-year prospective study. *J Sci Med Sport.* 2016; 19: 778-783. doi:10.1016/j.jsams.2015.12.515
- (28) **VAN REIJEN M, VRIEND I, VAN MECHELEN W, FINCH CF, VERHAGEN EA.** Compliance with Sport Injury Prevention Interventions in Randomised Controlled Trials: A Systematic Review. *Sports Med.* 2016; 46: 1125-1139. doi:10.1007/s40279-016-0470-8
- (29) **RUFFAULT A, SORG M, MARTIN S, HANON C, JACQUET L, VERHAGEN E, EDOUARD P.** Determinants of the adoption of injury risk reduction programmes in athletics (track and field): an online survey of 7715 French athletes. *Br J Sports Med.* 2022; 56: 499-505. doi:10.1136/bjsports-2021-104593
- (30) **SMYTH EA, NEWMAN P, WADDINGTON G, WEISSENSTEINER JR, DREW MK.** Injury prevention strategies specific to pre-elite athletes competing in Olympic and professional sports — A systematic review. *J Sci Med Sport.* 2019; 22: 887-901. doi:10.1016/j.jsams.2019.03.002
- (31) **SUNG Y-T, WU J-S.** The Visual Analogue Scale for Rating, Ranking and Paired-Comparison (VAS-RRP): A new technique for psychological measurement. *Behav Res Methods.* 2018; 50: 1694-1715. doi:10.3758/s13428-018-1041-8
- (32) **VRIEND I, GOUTTEBARGE V, FINCH CF, VAN MECHELEN W, VERHAGEN EALM.** Intervention Strategies Used in Sport Injury Prevention Studies: A Systematic Review Identifying Studies Applying the Haddon Matrix. *Sports Med.* 2017; 47: 2027-2043. doi:10.1007/s40279-017-0718-y
- (33) **YEUNG SS, SUEN AMY, YEUNG EW.** A prospective cohort study of hamstring injuries in competitive sprinters: Preseason muscle imbalance as a possible risk factor. *Br J Sports Med.* 2009; 43: 589-594. doi:10.1136/bjism.2008.056283