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Risk factors for injury complaints leading to restricted participation in Athletics (Track and Field): a secondary analysis of data from 320 athletes over one season

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ABSTRACT

Objective To investigate if several potential risk factors were associated with time to injury complaints leading to participation restriction in Athletics (ICPR).

Methods We performed a secondary analysis of data collected during 39 weeks of the 2017–2018 Athletics season in a cluster-randomised controlled trial ('PREVATHLE'). Univariate and multivariable analyses using Cox regression models were performed to analyse the association between the time to first ICPR and potential risk factors collected (1) at baseline: sex, age, height, body mass, discipline, the usual duration of Athletics training and non-specific sports training, ICPR in the preceding season (yes/no), ICPR at baseline (yes/no); (2) weekly during the season: duration and intensity of Athletics training and competition, and non-specific sports training, fitness subjective state, sleep duration and illness (yes/no); and (3) combined.

Results Data from 320 athletes were included; 138 (43.1%) athletes reported at least one ICPR during the study follow-up. The combined multivariable analyses revealed that the risk of ICPR at any given time was significantly higher in athletes with a pre-existing ICPR (hazard rate ratio, HRR 1.90, 95% CI 1.15 to 3.15; p=0.012) and lower in athletes with a higher fitness subjective state (HRR 0.63, 95% CI 0.55 to 0.73; p<0.001) and who had had at least one illness during the season (HRR 0.42, 95% CI 0.29 to 0.62; p<0.001).

Conclusions Our results provide new insights into injury risk factors in Athletics that could help with potential injury risk reduction strategies. These could be to explore the pre-existing injury presence at the season's beginning and to monitor the fitness subjective state and illnesses occurrence during the season.

Trial registration ClinicalTrials.gov Identifier: NCT03307434

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Training and competing in Athletics (Track and Field) is associated with a risk of sustaining injuries.

⇒ Some risk factors have been reported to be associated with injuries in Athletics: previous injuries, male sex, older age, competing in combined events or middle-distance and long-distance running, high training load, use of spikes, the psychological factor 'self-blame', and lifetime sexual and physical abuse.

⇒ There is a need to extend this knowledge to help the development of injury risk reduction strategies.

WHAT THIS STUDY ADDS

⇒ At any given time, athletes with pre-existing injury complaints had a higher risk of having an injury complaint leading to participation restriction in Athletics during the season.

⇒ Athletes with a higher subjective state of fitness and athletes having had at least one illness had a lower risk of having an injury complaint leading to participation restriction in Athletics.

⇒ Our results suggest that careful attention should be given to athletes with pre-existing injury complaints leading to participation restriction in Athletics at the start of the season and to athletes with a lower subjective state of fitness during the season.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ At the start of a season, athletes with a current injury complaint that leads to restriction in Athletics participation should be carefully managed until they return to sport. Then, specific attention should be given to return to sports periods due to their higher injury risk at any given time and to the fact that these injury complaints were associated with reduced time to further injury complaints. During the season, monitoring the subjective fitness status could be a way to estimate the athletes' injury risk. Athletes with low subjective status of fitness might have a higher injury risk.

INTRODUCTION

The injury risk associated with training and competing in Athletics (Track and Field)

supports the need to develop injury risk reduction strategies.[1 2] These should be based on understanding the extent of the problem and the factors leading to the injury.[3] Several epidemiological studies on Athletics injuries during seasons and/or championships have been published,[4–8] and the following risk factors for injuries in Athletics have been reported: previous injuries,[6 9–11] male sex,[4–6 12] older age,[4–6 13 14] competing in combined events or middle-distance and long-distance running,[8] high training load,[6 15 16] use of spikes,[16] the psychological factor 'self-blame',[17] and lifetime sexual and physical abuse.[18] However, the current knowledge of Athletics-related injury risk factors is limited. Some factors have been reported only in a few studies, which can limit the validity of the conclusions that can be drawn (eg, discipline[8] and psychological[17 18] factors). The study design (eg, retrospective[4 5 18]), population (eg, small sample size[15]) or period (eg, short follow-up duration[11–15]) could also limit the validity of the reported risk factors. In addition, few potential injury risk factors have been explored and evaluated in comparison to the multifactorial nature of the injury.[19] Therefore, we aimed to investigate if several potential risk factors observed before and during an Athletics season were associated with time to injury complaints leading to participation restriction in Athletics (ICPR).

METHODS

Study design and overall procedure

This is a secondary analysis of the data collected during 39 weeks of the 2017–2018 Athletics season in the cluster-randomised controlled trial (RCT) 'PREVATHLE'.[20] The original "PREVATHLE" study was approved by the Committee for the Protection of Persons (CPP Ouest II—Angers, number: 2017-A01980-53) and registered on ClinicalTrials.gov (Identifier: NCT03307434). The use of the data for the present study was reviewed and approved by the Saint-Etienne University Hospital Ethical Committee (Institutional Review Board: IORG0007394; IRBN IRBN292023/CHUSTE). All subjects included in the present study were informed about the present study's aim and procedure, that their data were used for this new analysis, and their rights to refuse that their data be used for research. The Ethical Committee required no new signed informed consent.

Inclusion criteria

In this analysis, we included data from athletes who took part in the PREVATHLE study and met all following criteria: (1) agreed to participate, provided written informed consent and met the inclusion criteria of the PREVATHLE study at the start of the 2017–2018 athletics season[20]: licensed at the French Federation of Athletics (FFA) in a club of at least 15 athletes, aged between 15 and 40 years, having internet access and no contraindications for competitive Athletics activity attested by the license at the FFA; (2) answered in full the baseline questionnaire; (3) responded to at least the first weekly questionnaire and (4) were allocated to the control group or, if allocated to the intervention group, reported to have never performed the requested intervention aimed at reducing the risk of injury (ie, the unsupervised exercise-based injury prevention programme[20]).

Patient and public involvement

Athletes and the public were not involved in the trial design, the conduction of the present study or the choice of outcome measures. A summary of the study results will be disseminated to the public.

Definitions

An injury complaint was defined as: 'a pain, physical complaint or musculoskeletal lesion sustained by an athlete, regardless of whether it received medical attention or its consequences with respect to impairments in connection with competition or training'.[20–22] We chose the term 'injury complaint', which has been previously used in the literature,[20 22] since it refers to self-reported information without medical diagnosis.[23] As reported by Bahr *et al*,[24] the definition used in the present study is not a medical attention or time-loss injury definition, but we include 'any complaint'. An injury complaint that leads to restriction in Athletics participation (ICPR) was defined as an 'injury complaint' reported by athletes sustained during participation in Athletics training or competition, and that leads to reduced participation or full absence in Athletics.[20] We focused our analysis only on injuries that impacted the Athletics practice by leading to reduced or no participation in Athletics, given the importance for end-users of the availability to train and compete.

An illness was defined as a physical or psychological complaint or manifestation by an athlete not related to injury, regardless of whether it received medical attention or its consequences with respect to impairments in connection with competition or training.[21]

Data collection and outcomes

Baseline information was collected at the start of the 2017–2018 Athletics season from each included athlete using a Google Forms (Google) survey: sex (female/male), age, height, body mass, Athletics discipline (ie, sprints, hurdles, jumps, throws, combined events, middle and long distances, marathon, race walking, road running, and trail and mountain running), duration of usual weekly Athletics training (in hours), duration of usual weekly non-specific sports training (in hours), and ICPR during the preceding season (yes/no).[20] Non-specific sports included all sporting activities not included or planned as training for Athletics. We categorised sprints, hurdles, jumps, throws and combined events as 'explosive' disciplines, while middle and long distances, marathon, race walking, road running, and trail and mountain running were considered 'endurance' disciplines.[11]

During the 39 weeks of the season, information was prospectively collected using a weekly self-reported online

questionnaire on a secured website called 'PREVATHLE' (Windows Server 2013 R2 64 bits—SP2; IBM DOMINO 9.01 fix pack 8).[20] Each Monday, all included athletes were asked to report information on the preceding week regarding the total number of Athletics training hours, Athletics training intensity (low (scored 1), moderate (scored 2), hard (scored 3)), total number of Athletics competition hours, intensity of Athletics competition (always scored 3), total number of non-specific sports training hours, intensity of non-specific sports training (low (scored 1), moderate (scored 2), hard (scored 3)), subjective state of fitness (numeric analogic scale from 0 to 10), sleep duration (mean number of hours per night), and any illness and injury complaints (yes/no). When athletes reported an injury complaint, they were asked to report the following details: date of start, circumstance (training, competition, outside of Athletics), mode of onset (sudden or gradual), body part and consequence on Athletics participation (full participation with no discomfort, full participation with discomfort, reduced participation, full absence from sport).[20]

If an athlete reported in the first weekly questionnaire an ICPR that occurred before the preceding week (ie, before the start of the follow-up), the athlete was noted as having a pre-existing ICPR and not as having been injured during the first week. In this case, we analysed the time between the start of the follow-up and the next ICPR for the present study. As pre-existing ICPR represented the status of an athlete at the start of the follow-up, pre-existing ICPR was included in factors collected at baseline for the analyses.

The primary outcome of the present study was the time (in weeks) to the ICPR.

Statistical analysis

We conducted the statistical analysis using the software R V.4.2.0 (V.4.2.0, Copyright 2016 The Foundation for Statistical Computing (Comprehensive R Archive Network, http://www.R-project.org; accessed on 28 February 2023)).

We first performed a descriptive analysis, which included the frequencies and percentages for categorical variables and the means and SD for continuous variables.

We used a time-to-event approach to analyse potential risk factors associated with ICPR.[25] To do that, we adjusted Cox proportional hazards regression models to analyse the association between the primary outcome (ie, time in weeks to the first ICPR) and potential injury risk factors collected (1) at baseline: sex, age, height, body mass, discipline category (endurance/explosive disciplines), usual Athletics training exposure, usual non-specific sports training, ICPR during the preceding season (yes/no), and pre-existing ICPR at the start of the study (yes/no) and (2) weekly during the season: duration and intensity of Athletics training and competition, and non-specific sports training, subjective state of fitness, sleep duration, and occurrence of illness (yes/no). For the weekly data, we calculated the means of these parameters from the start of the follow-up until the first ICPR or until the participant was right-censored in the analysis. Participants were considered as right-censored (ie, had incomplete data on the study outcomes at the right side of the follow-up period) if they stopped completing the questionnaires or if they had an injury complaint that led to restriction in Athletics participation that occurred outside of Athletics activity, or if they have not had an injury at the end of the follow-up. To build the Cox models, we followed the purposeful selection approach described by Hosmer and Lemeshow,[26] which included first performing univariate analyses for each of the dependent variables and then including those covariates for which $p<0.25$ is observed in the univariate analysis in the final model. We applied this procedure independently for the data collected (1) at baseline, (2) weekly during the season and (3) at baseline and weekly during the season combined. The hazard rate ratio (HRR) with a 95% CI was presented for each variable. Statistical significance was accepted at $p<0.05$.

RESULTS

Population

Out of 840 athletes who were initially included in the 'PREVATHLE' study,[20] 320 were used in the present study (figure 1). Among the 520 excluded participants, 310 did not respond to the baseline questionnaire, 51 did not respond to the first weekly questionnaire and 159 performed the requested intervention at least once (figure 1). The characteristics of the athletes included in this analysis are presented in table 1. There were no missing data in the 320 included athletes before they were right-censored.

A total of 138 of the 320 included athletes (43.1%) reported at least one ICPR during the study follow-up. The mean time between the start of the study follow-up and the ICPR was 8.9±8.9 weeks. Moreover, 26 (8.1%) athletes reported an injury complaint occurring outside of Athletics, 21 (6.6%) athletes did not report any ICPR during the 39-week follow-up and 135 (42.2%) stopped responding to the weekly questionnaire before the end of the follow-up.

Risk factor analysis

The analysis of potential baseline injury risk factors revealed that the risk of ICPR at any given time was significantly higher in athletes with a pre-existing ICPR (HRR 3.45, 95% CI 2.19 to 5.46; $p<0.001$) (table 2).

The analysis of potential injury risk factors that were collected during the season revealed that the risk of ICPR at any given time was significantly lower in athletes with a higher subjective state of fitness (HRR 0.61, 95% CI 0.53 to 0.69; $p<0.001$) and having had at least one illness (HRR 0.41, 95% CI 0.28 to 0.59; $p<0.001$) (table 2).

When combining both the baseline and the weekly collected potential injury risk factors, the analysis showed that the risk of ICPR at any given time was significantly higher in athletes with a pre-existing ICPR (HRR 1.90, 95% CI 1.15 to 3.15; $p=0.012$), and lower in athletes with

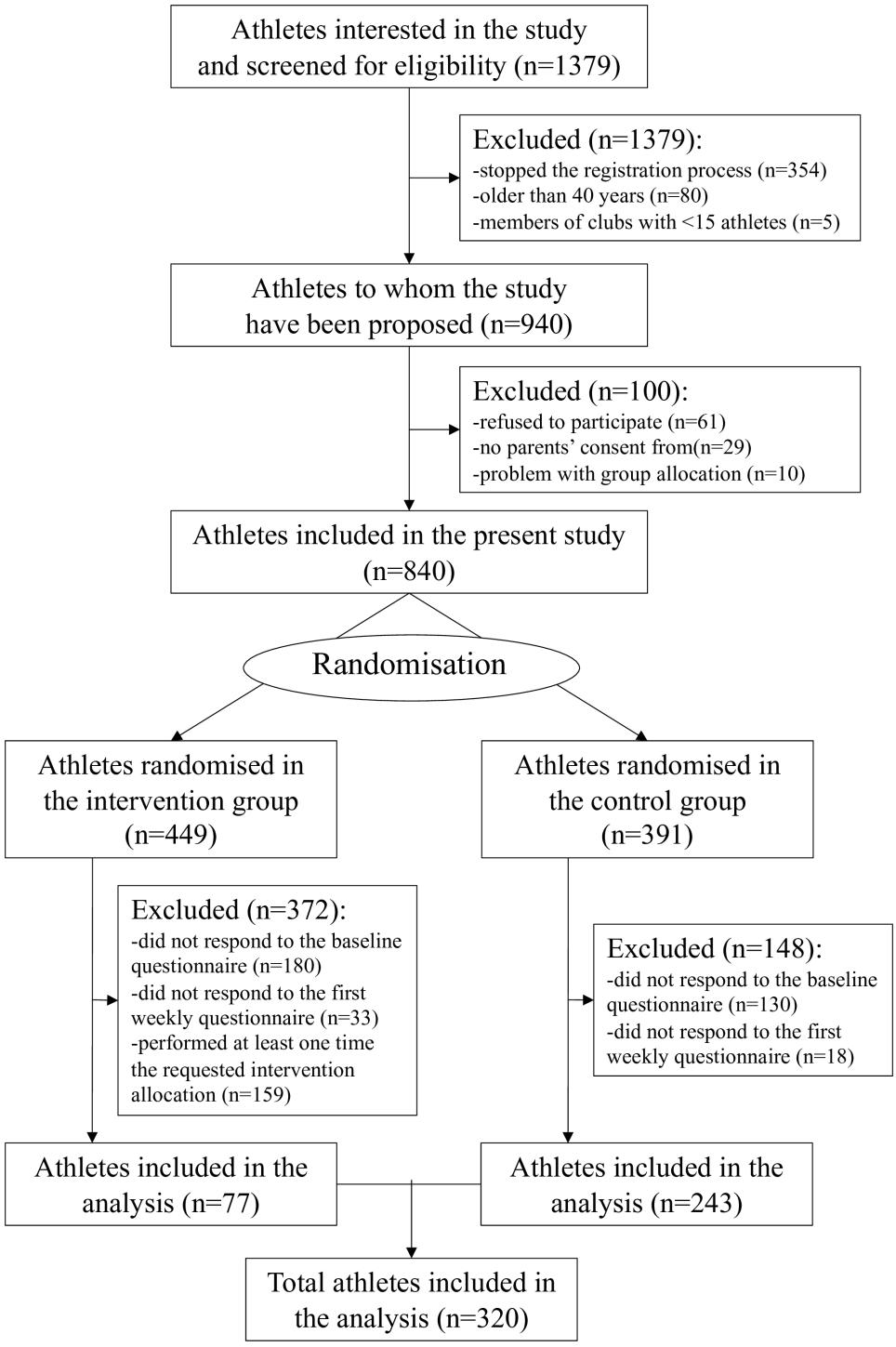

Figure 1 The Consolidated Standards of Reporting Trials (CONSORT) flow diagram of the study.

higher subjective state of fitness (HRR 0.63, 95% CI 0.55 to 0.73; p<0.001) and who had had at least one illness (HRR 0.42, 95% CI 0.29 to 0.62; p<0.001) (table 2).

DISCUSSION

The main findings of the present study were that athletes with a pre-existing ICPR had a higher risk at any given time of sustaining an ICPR during the season, while athletes with a higher subjective state of fitness and athletes having had at least one illness had a lower risk at any given time of sustaining an ICPR. More specifically, athletes with a pre-existing ICPR had a~2 times higher risk of sustaining an ICPR at each time. Also, every increase of 1 point in the subjective state of fitness was associated with an almost 40% lower risk of sustaining an ICPR. Finally, athletes having had at least one illness had almost 60% lower risk at each time of sustaining an ICPR.

Table 1 Baseline characteristics of the 320 included athletes

	Total no of included athletes (n=320)	
Sex (n (%))		
Female athletes	125	(39.1)
Male athletes	195	(60.9)
Age (years) (mean (SD))	30.3	(6.5)
Height (cm) (mean (SD))	173.1	(8.4)
Body mass (kg) (mean (SD))	64.6	(11.5)
Disciplines (n (%))		
Endurance	253	(79.1)
Explosive	67	(20.9)
Usual weekly Athletics training volume (hours) (mean (SD))	5.5	(2.6)
Usual weekly non-Athletics sports volume (hours) (mean (SD))	2.6	(2.8)
History of ICPR during the preceding season (n (%))		
No	171	(53.4)
Yes	149	(46.6)
Pre-existing ICPR (n (%))		
No	280	(87.5)
Yes	40	(12.5)

Data are presented as mean and SD for continuous variables and numbers and percentages (%) for ordinal or categorical variables.
ICPR, injury complaint leading to participation restriction.

Non-modifiable risk factors

Our present results provide additional evidence to support that having had a previous injury is one of the main risk factors for sustaining a new one.[6 9–11] Our results and analyses slightly differed from previous studies because (1) we did not collect lifetime injury history but only injury history during the previous season, (2) injury history during the previous season was not associated with a new injury, but (3) we performed time-to-event analyses reporting that a pre-existing injury (ie, ICPR at the start of the study, collected during the first weekly questionnaire) was associated with higher risk at any given time of ICPR or with a shorter time before a new ICPR. However, our results confirmed the importance of this non-modifiable risk factor of previous injury history, whatever the extent of the history (ie, lifetime, previous year, previous season, pre-existing). As previously discussed, possible hypotheses could be that the previous injury led to weakness due to incomplete tissue healing, no modification of underlying risk factors, other body/tissue weakness due to detraining, and/or interferences with physical conditioning and/or technical preparation.[11 23 27]

Our results did not confirm that male athletes were at higher risk of injuries, as previously reported.[4–6 12] Age was also not reported to be associated with higher injury risk, contrary to previous studies reporting older age.[4–6 13 14] Furthermore, no association was found for the discipline groups, which could be explained by grouping athletic disciplines into explosive and endurance. As some explosive and endurance disciplines (ie, combined events and middle- and long-distance running[8]) have been reported to be associated with higher injury risk, the grouping could have diluted these potential risk factors. However, given the sample size, we thought a factor with nine categories could have been a limit in the analysis.

Finally, we reported that athletes having had at least one illness had a lower risk at any given time of sustaining an ICPR. This result could be considered surprising given that (1) a previous study reported that previous illnesses were associated with a higher risk of sustaining an injury during major competition[28] and (2) it would be pathophysiologically consistent that having an illness could increase the risk of sustaining an injury by leading to body/tissue weakness due to detraining and/or physical deconditioning. Explanations could be (1) the decreased exposure to injury due to a full break or reduced Athletics participation induced by the illness, (2) the rest period induced by the illness leading to increased musculoskeletal recovery, and/or (3) the analytical approach with time-to-event analyses calculating an instantaneous risk.

Modifiable risk factors

In our study, we prospectively collected information regarding the training load: volume and intensity for Athletics training, Athletics competition and non-specific sports training. None of the parameters were significant in the multivariable analyses. This could be considered surprising given that higher training load has been reported to be associated with higher injury risk,[6 15] injury risk is often higher during competition,[7 29] the more athletes participate in the competition and/or in training, the more they are exposed to the injury risk. There is probably a need to confirm this result in further studies. Otherwise, we chose not to combine training and intensity into a combined index of load to keep separate the information about these two important aspects of training and, therefore, not bias the results.[30]

We collected information about the subjective fitness status to capture an estimation by the athletes (self-reported feelings) about their fitness and fatigue. Although subjective, we thought this parameter could be an additional one to explore the training load. We also thought that the athletes' perception towards their fitness could be a relevant parameter to managing injury risk. Our results reported that athletes with a higher subjective state of fitness had a lower instantaneous risk of sustaining an ICPR. This confirms the interest in this parameter and is consistent with pathophysiological aspects.[30] There is, however, a need to confirm this result with further studies. The athletes' feelings could not only

Table 2 Results of the Cox proportional hazards regression analysing the association between the primary outcome (ie, time to the first ICPR) and potential risk factors data collected (1) at baseline (corresponding to potential risk factors that existed before the season), (2) weekly during the season (corresponding to potential risk factors that occurred during the season) and (3) both combined

	Univariate analysis			Multivariable analysis separated for baseline and weekly collected risk factors			Multivariable analysis combined for baseline and weekly collected risk factors		
	HRR	(95% CI)	P value	HRR	(95% CI)	P value	HRR	(95% CI)	P value
Baseline parameters									
Sex (reference male athletes)	1.04	(0.73 to 1.48)	0.826	–	–	–	–	–	–
Age	0.99	(0.97 to 1.02)	0.438	–	–	–	–	–	–
Height	1.02	(0.99 to 1.04)	0.158	1.02	(0.99 to 1.04)	0.189	1.01	(0.99 to 1.03)	0.343
Body mass	1.01	(0.99 to 1.02)	0.348	–	–	–	–	–	–
Discipline (reference explosive)	1.02	(0.68 to 1.53)	0.913	–	–	–	–	–	–
Usual Athletics training (hours)	0.98	(0.91 to 1.05)	0.509	–	–	–	–	–	–
Usual non-specific sport training (hours)	1.02	(0.95 to 1.09)	0.634	–	–	–	–	–	–
History of ICPR during the preceding season (reference yes)	1.16	(0.83 to 1.63)	0.374	–	–	–	–	–	–
Pre-existing ICPR (reference yes)	**3.49**	**(2.21 to 5.51)**	**<0.001**	**3.45**	**(2.19 to 5.46)**	**<0.001**	**1.90**	**(1.15 to 3.15)**	**0.012**
Weekly prospectively collected parameters									
Athletics training volume	0.95	(0.88 to 1.03)	0.219	0.97	(0.88 to 1.06)	0.464	0.97	(0.88 to 1.06)	0.476
Athletics training intensity	0.81	(0.58 to 1.15)	0.244	1.28	(0.85 to 1.93)	0.234	1.30	(0.85 to 1.99)	0.225
Athletics competition volume	**0.60**	**(0.37 to 0.95**	**0.029**	0.67	(0.41 to 1.10)	0.117	0.67	(0.41 to 1.10)	0.116
Athletics competition intensity	0.70	(0.47 to 1.03	0.069	1.07	(0.69 to 1.64)	0.765	1.15	(0.74 to 1.77)	0.533
Non-specific sports training volume	0.89	(0.78 to 1.01)	0.065	0.98	(0.88 to 1.09)	0.699	0.98	(0.88 to 1.10)	0.774
Non-specific sports training intensity	0.87	(0.65 to 1.17)	0.369	–	–	–	–	–	–
Subjective state of fitness	**0.63**	**(0.56 to 0.72)**	**<0.001**	**0.61**	**(0.53 to 0.69)**	**<0.001**	**0.63**	**(0.55 to 0.73)**	**<0.001**
Sleep duration	1.02	(0.89 to 1.16)	0.782	–	–	–	–	–	–
Illness (reference yes)	**0.46**	**(0.32 to 0.67)**	**<0.001**	**0.41**	**(0.28 to 0.59)**	**<0.001**	**0.42**	**(0.29 to 0.62)**	**<0.001**

Bold values are for significant HRR (when 1 is not included in the 95% CI). HRR above 1 indicates a tendency for the reference group to have an increased instantaneous risk of ICPR.
HRR, hazard rate ratio; ICPR, injury complaints leading to participation restriction.

be physical but also include their psychological perceptions. More information regarding the psychological aspects represents an important and relevant perspective in understanding the factors associated with injury in Athletics. It allows a more global view of the athletes' health.[17 31]

Limitations

The 'PREVATHLE' RCT was not designed for the present study's aim of analysing factors associated with time to ICPR. Several athletes were considered right-censored in the analysis because they stopped replying to the weekly questionnaires (42.2%) or because of an injury complaint occurring outside of Athletics (8.1%), so the number of injured athletes could have been underestimated.[7 20] The included population was not balanced regarding sex and discipline. We included in the analysis athletes allocated to the intervention group who reported to have never performed the requested intervention to reduce the risk of injury. This may induce a potential selection bias as these athletes might be systematically different from those allocated to the intervention group and comply with the training programme. The 'subjective state of fitness' variable measured the athletes' self-declared estimation of their feelings of fitness (fatigue vs physical form or energy), which is subjective and can result from several components. The presence of an injury during the preceding week could be associated with a low 'subjective level of fitness' and could consequently induce a bias. However, for the weekly data, we calculated the means of these parameters from the start of the follow-up until the first ICPR or until the participant was right-censored in the analysis. Although we prospectively collected some parameters, the Cox regression did not allow us to consider the potential variations of these weekly collected parameters during the time, and it was only a mean over the data collection period. Considering

the temporality and the time-variation of the parameters in the analyses represents an important perspective.[25 32]

Practical implications

Our results have practical implications for athletes, coaches, clinicians and researchers. At the start of a season, athletes with a current injury should be carefully managed until they return to sport. Then, specific attention should also be put after return to sport given their higher injury risk at any given time and that pre-existing ICPR was associated with a shorter time to first ICPR. This could mean rehabilitating, following all injuries until the complete tissue healing and maximal capabilities are recovered, and then continuous monitoring with the aim of no sequel deficiency.[33] During the season, monitoring the subjective fitness status could be an indicator to detect athletes with higher injury risk. And there is probably a need to better take into account when an athlete mentions a low subjective fitness status. This implies communication between athletes, coaches, and their entourage, which thus represents one important aspect of the injury risk reduction approach.[31 34 35] In addition, an illness could be considered more positively as an opportunity to recover.

Researchers need to continue to extend the knowledge on Athletics-related injury risk factors, increase the domains explored (physical, psychological and societal), and increase the analytical approach to match better the temporality associated with the injury risk.

CONCLUSIONS

This study reported important information to extend the knowledge on the factors associated with Athletics-related injuries: athletes with a pre-existing ICPR had a higher risk at any given time of sustaining an ICPR, while athletes with a higher subjective fitness and having had at least one illness had a lower risk at any given time of sustaining an ICPR. Our results suggest that careful attention should be given to athletes with a pre-existing ICPR at the start of the season and athletes with a lower subjective state of fitness during the season through appropriate rehabilitation and prospective monitoring.

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Contributors PE conceived the study and drafted the manuscript. PE and DB performed data analyses. All coauthors discussed the study design, the data analysis, contributed substantially to interpreting the results and revision of the manuscript, and approved the final manuscript. All authors understand that they are accountable for all aspects of the work and ensure the accuracy or integrity of this manuscript. PE acts as guarantor of the study.

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Competing interests None declared. PE and KH are Associate Editors for the BMJ Open Sports and Exercise Medicine. PE is an Associate Editors for the Brit J Sports Med.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants; and in the present study, we used data from a cluster-randomised controlled trial that was approved by the Committee for the Protection of Persons (CPP Ouest II—Angers, number: 2017-A01980-53), and was registered in the ClinicalTrials.gov (ClinicalTrials.gov Identifier: NCT03307434). This present study and analysis were reviewed and approved by the Saint-Etienne University Hospital Ethical Committee (Institutional Review Board: IORG0007394; IRBN292023/CHUSTE). Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. Data are available on reasonable request, similarly than for the publication of the results of the cluster-randomised controlled trial. Requests for data sharing from appropriate researchers and entities will be considered on a case-by-case basis. Interested parties should contact the corresponding author PE (pascal.edouard@univ-st-etienne.fr).

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