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Injuries in Athletics (Track and Field): A Narrative Review Presenting the Current Problem of Injuries

Verletzungen in der Leichtathletik: Ein narrativer Überblick über die aktuelle Verletzungsproblematik

Summary

› **Objective:** In Athletics (Track and Field), athletes can be affected by injuries, especially in their quest for top performance. Therefore, we aim to provide an overview of the current knowledge about the problem of injuries in Athletics.

› **Main findings:** It is necessary to maintain a clear definition of "injury" when stakeholders in Athletics discuss clinical, administrative, and/or research perspectives. There are several possible methodological approaches to collect injury data in Athletics depending on the context, population, and injury definition. In general, about two thirds of Athletics athletes sustain at least one injury during an Athletics season, and there are about 100 injuries per 1000 registered athletes during an international championship. The injury rates and characteristics vary by sex and discipline. The injuries can affect athletes physically, psychologically, and socially, with short- and long-term consequences for musculoskeletal function, athletics performance and athletics career. Although it is logical to try to reduce the injury risk, little scientific evidence is currently available to help Athletics-related stakeholders.

› **Conclusions:** Injury can currently be considered as an omnipresent problem in Athletics, which affects their practice, with consequences on performance and health. Injury risk is today an undeniable part of the life of Athletics athletes, which implies that there is a pressing need to continue the development of injury risk reduction strategies, to scientifically evaluate their efficacy, and to implement them in sports practice.

KEY WORDS:
Risk Reduction, Injury Prevention, Epidemiology, Behaviours, Adherence.

Introduction

Athletics (Track and Field) is an Olympic sport, practiced all over the world. It is governed at the international level by the World Athletics, which has a total of 214 affiliated countries or territories worldwide. This makes Athletics an intercultural sport involving athletes of different sexes, ages, ethnicities, and socioeconomic environments. Athletics is composed of several different disciplines, including sprints, hurdles, jumps, throws, combined events, middle- and long-distance running, and race walking. There are other associated disciplines (i.e., cross country, mountain, ultra, and trail running) not included in the Olympic Games that will not be dealt with in the present review. Athletes, whatever their levels, typically train throughout the season and their career to perform at their best, participate in the highest level of competition and try to win medals. Athletics, like any physical and sports-related activity, leads to beneficial effects on health (73). However, in the quest for optimal performance, athletes can be affected by injuries (38), with potential physical, psychological, and social consequences (39, 47, 59, 76). Injury can thus represent an important aspect of the athlete's life, and for all Athletics-related stakeholders (e.g., coaches, health professionals, administrative leaders). Therefore, we aim to provide an overview of the current knowledge about the problem of injuries in Athletics. We thus performed a narrative review, with articles selected after search on PubMed/MEDLINE with the following keywords: ("Athletics" OR "Track and field" OR "pole vault" OR "sprint*" OR "relay" OR "hurdl*" OR "middle-distance*" OR "long-distance*" OR "steeplechase" OR "combined events" OR "decathlon" OR "heptathlon" OR "pentathlon" OR "throw*" OR "jump*" OR "race walk*" OR "athlet*") AND ("injur*"), written in English, French, or German, and by checking the reference lists of selected articles.

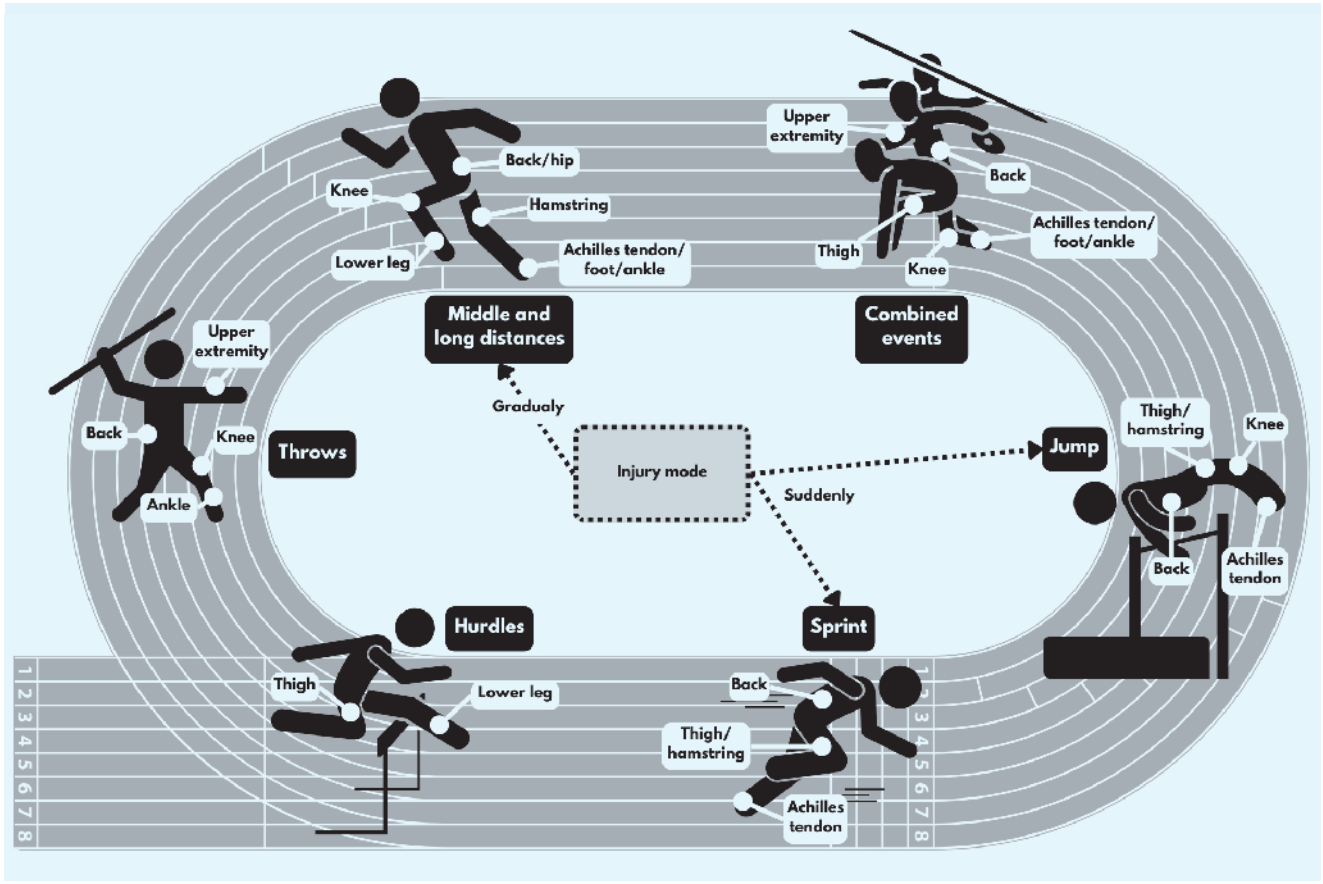

Figure 1

Distribution of injury locations by disciplines.

What Does Injury Mean?

The term "injury" is used when we are dealing with damage and/or dysfunction and/or impairment of a system. In the present context of Athletics, we are typically referring to damage/dysfunction/impairment of the musculoskeletal system (i.e., muscle, tendon, bone, cartilage, ligament, and soft tissue). When the load and strain resulting from Athletic practice exceeds the capabilities of the musculoskeletal system, there is a risk of failure of the musculoskeletal structure that results in an injury (43, 57, 72).

However, although focussed on the musculoskeletal system, "injury" is a broad term that can include several concepts. In 2014, Timpka and colleagues proposed definitions of "sports impairment" concepts based on the idea of impairment used by the World Health Organisation, resulting in different terms according to the involvement of the tissue, the athlete self-claims, or the consequences (87), and they analysed their occurrence in scientific publications (89). Bolling and colleagues (8) reported that the definition of sports injury was a fluid phenomenon and context-dependent concept, and the main constructs to define a sports injury as perceived by elite athletes, coaches, and physiotherapists were: (1) pain, (2) performance level, and (3) availability for sports participation. Bahr and colleagues (4) reported that sports injuries can be defined as an event that results in medical attention (i.e., an injury problem that results in an athlete receiving medical attention), time-loss (i.e., an injury problem that results in an athlete being unable to complete the current or future training session or competition), or it could be any type of complaint (i.e., a broader definition including all injury problem self-reported, symptom-based or performance-based whatever they lead to medical attention and/or time-loss). The most recent consensus statement on injury and illness definitions and data collection procedures for use in epidemiological studies in Athletics defined an athletics injury as: "A physical complaint or observable damage to body tissue produced by the transfer of energy experienced or sustained by an athlete during participation in Athletics training or competition, regardless of whether it received medical attention or its consequences with respect to impairments in connection with competition or training" (84). This consensus indicates that the sub-definitions of medical attention, time-loss, or any complaint could also be used (4). This variety of interpretations of the term "injury" demonstrates the complexity surrounding how to define injury – highlighting the need to provide a clearer definition of this term when Athletics-related stakeholders are interacting for clinical, administrative, and/or research purposes.

How to Monitor Injuries in Athletics?

Given the impact of the data collection methodology on the quality of the data and thus the resulting information, greater attention should be paid to the methodology of epidemiological studies to adequately interpret and compare their results. The study design, the definition of injury considered in that study and its characteristics, the exposure, the data collection procedures, and data analyses are key points of the methodology of epidemiological studies (4, 84). In addition to the complex definition of injuries, the sport of Ath- ›

letics contributes to specific challenges for injury data collection (e.g., individual sport, training structure, health-related culture, medical organization) that should be taken into consideration when planning an injury data collection or an epidemiological study (23). The definition of injury as medical attention injury definition and data collection by health professionals has been used during Athletics championships (2, 68). This methodological approach was associated with good participations of national medical teams (about 80% of registered medical teams participated), good coverage of athletes (about 80% of registered athletes), good response rates (average of 89%), good completeness of reports (average of 96%) (25) and the generation of reliable information (37). During a whole athletics season, different injury data collection methods have been used (i.e., retrospective or prospective, athlete's self-report or health professionals' diagnosis) making direct comparison between studies difficult (23). Thus, the choice of the methods can depend on the context (e.g., level, geographic), population (e.g., sex, age, performance level), and injury definition (e.g., time loss, medical attention). As practical recommendations, we suggest that: (1) researchers reflect on their study objectives and context to choose the most suitable injury data collection method, and, (2) in regards to knowledge transfer, (2) readers pay attention to the injury definition and methods when interpreting the results of the studies and iii) follow current consensus guidelines (4, 84).

What is the Extent of the Injury Problem in Athletics?

Having acknowledged the different methodological approaches to collect injury data, we now present the extent of the injury problem in Athletics, divided according to two contexts: (1) Athletics championships and (2) whole Athletics seasons (including training/preparation and competitions).

The Extent of the Injury During Athletics Championships

During international Athletics championships, the combination of data from several championships provides a clearer view of the injury problem (33, 40, 54). In this context, significantly higher injury risk (+25%) in male than female athletes (110.3 ± 6.8 vs. 88.5 ± 6.7 injuries per 1000 registered athletes) have been reported (33). In addition, there was a significant variation in injury rates and characteristics between disciplines: thigh muscle injuries were the main injury diagnoses in sprints, hurdles, jumps, combined events and race walking, lower leg muscle injuries in marathons, lower leg skin injuries in middle and long distances, and trunk muscle and lower leg muscle injuries in throws (40). The most frequent injury was the hamstring muscle injury (about 17% of all injuries), with a higher proportion in disciplines that require sprint running (e.g., in sprints hamstring injuries represented 35% and 24% of all injuries in male and female athletes, respectively (24, 34). About 30% of the athletes reported an injury complaint within the four-week preparation period before the championships (36).

During the French national indoor and outdoor championships from 2014 to 2017, there were 53 injuries per 1000 registered athletes, with quite similar rates at each championship (31). The thigh was the most common injury location (about 30% of all injuries) and the muscle was the first injury type (about 30% of all injuries) (31). During three years of Penn Relay Carnival, corresponding to the oldest and largest Athletics competition in the United States, there were 9 injuries per 1000 registered athletes (74), with hamstring muscle strain accounting for 24% of injuries (75). During the 2016 track and field Olympic trials, there were 60 injuries per 1000 registered athletes, with hamstring muscle strain accounting for 17% of injuries (6).

The Extent of the Injury Problem during Athletics Seasons

The Athletics season represents a larger period in the athletes' life of athletics practice, and consequently a longer period of exposure to the risk of injuries than during championships. Although the methods (i.e., study design, injury definition, data collection) were not the same between the studies that reported data collected during the whole athletics season, it seems that there are some consistencies and similarities among them on injury prevalence, incidence, and characteristics (21). In general, about two-thirds of athletes had at least one injury during the entire athletics season (5, 11, 19, 30, 67, 71). The incidence was reported as 3.6-3.9 injuries per 1000 hours of track and field practice (5, 19, 67). In the National Collegiate Athletic Association (NCAA), an overall injury rate of 2-4 injuries per 1000 athletic-exposures was reported between 2010 and 2019 (9, 58). The location of injuries varied according to the disciplines, and are presented in figure 1 (21). The injury mode of onset was more sudden in explosive disciplines (e.g., sprints, jumps) and more gradual in endurance disciplines (e.g., middle- and long-distance, marathon) (figure 1) (21). The hamstring muscle injury was also frequently reported as the first injury during the whole season (24, 26, 42, 60, 69, 77, 78).

What are the Consequences of Injuries in Athletics?

Performance-Related Consequences

Among the variables that can influence the athlete´s performance, having no injury or illness seems to be especially important (18). In athletics, plenty of articles reported the negative effect of injuries on performance (e.g., during the context of championships, in the preparation of championships) (12, 41, 44, 79).

Physical-Related Consequences

In general, damage to the musculoskeletal system can lead to pain and impairment of the musculoskeletal system, which can lead to dysfunction, impairment of motion and/or stability. This has negative consequences on daily life, physical activity (restriction of motion) due to pain and dysfunctionality (decrease in function) depending on injury site, type, and severity (43). Injuries can also lead to long-term sequelae depending on the initial injury damage and/or management, which may have long-term consequences for the athletes and is associated with an increased risk of subsequent injuries (39, 76).

Psychological-Related Consequences

In sports in general, it has been reported that sports injuries can lead to psychological consequences (95), and in Athletics, athletes who experienced an injury reported negative emotions (47). Specific to elite track athletes (53), six injury narrative typologies have been identified that provide insight related to individual differences in how injury is experienced from a psychological perspective. The psychological-related consequences should be identified by the clinicians and ma-

Table 1

Current knowledge on injury risk factors in Athletics.

	DURING THE ENTIRE ATHLETICS SEASON	DURING INTERNATIONAL ATHLETICS CHAMPIONSHIPS
Intrinsic non-modifiable risk factors	Previous injury: a previous injury seems to be a risk factor for another injury (33, 83, 84, 85)	Sex: male athletes had higher injury rates than females (21)
	Sex: the influence of sex remains unclear, higher risk in male (31, 32, 33) or in female athletes (86, 87) according to studies	Age: higher injury rates are reported in athletes over 30 years (90)
	Age: lower prevalence of injuries among juniors (<20 years) and higher among older athletes (31,32)	Injury before a championship: an injury complaint in the 4 weeks before the championship is a risk factor for a new injury during the championship (25)
	Lifetime sexual and physical abuse (88)	
	A history of illness within the season: it was associated with a lower injury risk (85)	
	Biomechanical pole vault patterns: it was associated with a higher injury risk (89)	
Intrinsic modifiable risk factors	Fitness status / fatigue: a higher fitness subjective state at any time was associated with a lower injury risk (85)	
	Performance level: the influence of the performance level remains unclear, the injury incidence increased with increased level (86), or decreased with increased level (31), or no influence (32)	
	Maladaptive coping practice of self-blame was found to be associated with increased risk of overuse injuries (91)	
Extrinsic risk factors	Coach: fewer injuries in athletes who trained with a coach compared to athletes training alone (31)	Discipline type: injury rates varied according to disciplines with higher injury rates in combined events, marathon, middle and long-distances (22)
	Training load: higher training load, calculated as volume x intensity, lead to higher injury rates in one study (33)	Training volume: higher training volumes before championships were associated with higher injury rates during championships (based on a pilot study of 74 athletes) (93)
	Spikes in training (92)	Participation in finals (94,95)
		External temperature (96)

naged, as physical-related consequences, so that there are no relevant psychological sequelae that imply future performance limitations.

Career-Related Consequences

Injuries can cause an interruption of sports, but also an interruption of the sports career because of one very severe injury, a repetition of injuries, or the sequelae of injury(ies). This alters the sustainable practice of Athletics (39, 76), likely to negatively impact an individual's athletic- and social-identity.

What are the Factors that Increase Injury Risk in Athletics?

Information about injury risk factors is of great interest to screen/detect athletes at potential risk of sustaining a new or recurrent injury, and can also be of help to orient the development of injury risk reduction strategies. The current knowledge on injury risk factors in Athletics are reported in the table 1. Although some factors are associated with higher injury rates (table 1), our knowledge of Athletics injury risk factors remains limited, supporting the need to continue performing studies that analyse potential risk factors of injuries in Athletics. In addition, in youth athletes, a qualitative study reported that injuries were not considered to be strictly the result of individual factors, but rather the result of the interactions between factors at different levels, including mainly: insufficient knowledge for athletic development in daily practice; short-sighted communities of practice and sports policies not adjusted to youth; and societal health behaviours (61).

What Can We Do to Reduce the Injury Problem in Athletics?

Given the extent and consequences of the injury, it is thus logical to try to reduce the injury risk. This overall goal is shared by Athletics-related stakeholders, representing a fertile ground for implementing injury risk reduction strategies (29, 45).

Injury Risk Reduction through Neuromuscular Exercises

Currently, and to our best knowledge, only one randomized controlled trial in Athletics-related Olympic disciplines has evaluated the efficacy of an exercises-based injury risk reduction programme and reported no significant differences – after a 39-week follow-up period – between the control and intervention groups for injury prevalence, burden, incidence, and time to first injury (49). However, compliance with the programme was low (49), and/or there were potential confounders (48). Based on the present results, it is not possible to promote its use, and efforts should continue to improve the programme itself, alongside the implementation and adoption of interventions more generally.

In endurance running, which also included athletes practicing non-Olympic athletics disciplines, a recent systematic review and meta-analysis reported that exercise-based interventions do not appear to reduce the risk and rate of running-related injuries, and highlighted the interest of exercise supervision to increase compliance (96).

Overall, there is little research on the development and analysis of the efficacy of neuromuscular exercise-based injury risk reduction programmes, and that an existing programme is effective enough to reduce the injury risk. ›

Injury Risk Reduction through Injury Prediction

The emerging practice of medicine and public health supported by electronic processes and communication (e-Health) in sports medicine represents an opportunity to develop new injury risk reduction strategies. Artificial intelligence approaches using machine learning techniques make it possible to provide an estimation of the injury risk at an individual level (14). Elite athletes, coaches, and health professionals reported a high perceived level of interest, and intent to use and help in this potential strategy, however, potential stress induced by injury prediction should be noted (15). It is now important to evaluate the efficacy of providing such individual feedback on injury risk to reduce the risk of sustaining an injury (14).

Injury Risk Reduction through Education

Education of athletes, their entourage, and all stakeholders within Athletics is largely viewed as an injury risk reduction approach (7, 10, 22). In addition, adequate health literacy would be relevant for promoting healthy Athletics activity. The level of health literacy regarding musculoskeletal health was reported to be insufficient in world-leading Athletics athletes (85), as well as in mentors and school-aged children involved in Athletics in Sweden (65). Among young Swedish athletes, a qualitative study reported that they were typically uncertain about how to acknowledge a sport-related injury and that their knowledge about injuries was obtained in part by reflecting on the lived experiences of their peers (64). Regarding specific medical issues related to female athletes, male coaches were less aware and less able to manage them, suggesting the need to better educate coaches on these aspects (92). There is thus a potential for improvement. Hence, Jacobsson and colleagues (63) reported in a cluster randomized controlled trial conducted on young athletes the efficacy of a digital health platform with athletics-specific training and health information (62) to reduce injury risk.

Another opportunity to educate the Athletics community is via social media, as a large majority of athletes and coaches are present on platforms like Instagram, and X (formerly Twitter) – viewed as a normal part of our society and life (1). It is suggested that sports clinicians embrace social media, which can be used to effectively implement healthcare interventions and even change public health policy through education. In the digital age, there is a lot of information circulating on social media about exercise and health. However, Marocolo et al. (70) concluded that prominent Brazilian Instagram influencers are spreading low-quality information about exercise and health, contributing to the widespread dissemination of misinformation to millions of followers. Poor knowledge of musculoskeletal health in world-leading Athletic athletes, combined with low-quality information on social media, should prompt us to further develop a strategy for reducing injury through education by dissemination of robust knowledge on different media like social media.

Other Injury Risk Reduction Approaches

Other injury risk reduction approaches could be relevant, although their efficacy has not been evaluated using the scientific method (20). These approaches can target athletes' biomechanics, lifestyle, psychology (55), medical organizations (16, 64), and federal policies (13, 86), or can consider an ecological (holistic-developmental) approach (61).

The Problem of Adherence to Injury Risk Reduction Approaches

Although injury risk reduction seems reasonable and relevant, and even if injury risk reduction represents a shared goal by the Athletics-related stakeholders (29, 45), injury risk reduction approaches are seldom adopted. For example, a randomised controlled trial reported that only 9% of athletes performed the exercises-based injury risk reduction programme as asked in this study (49). A study also pointed out that <30% of 7715 athletes self-declared having partially or fully adopted any exercise-based injury risk reduction program during their lifetime (83). A better understanding of the perceptions and beliefs towards injury risk reduction and the factors associated with adherence and non-adherence to injury risk reduction strategies can be a way to improve the adoption of injury risk reduction approaches (17, 27). The athletes who had sustained more injuries and competed at higher levels were more likely to adopt an exercise-based injury risk reduction programme and scored higher in socio-cognitive determinants (83). Another opportunity could be to take advantage of the fact that most athletes have suffered injuries in the past (7, 10, 22). An online survey of 7,870 athletes reported that athletes who experienced at least one injury during their lifetime were more likely to adhere to injury risk reduction strategies than athletes who had never experienced an injury (47). In addition, individualization of the injury risk reduction approach and its implementation could help to improve adherence to injury risk reduction approaches (27).

In addition, a challenge for the development and implementation of effective prevention programmes within a sport may be that it is not always clear in which context these should be applied (66). Programmes can either be clinically classified based on pathology or epidemiologically classified based on identified risk factors. For example, a clinically based programme can be an effective hamstring rehabilitation program (3) and an epidemiologically based a neuromuscular- or educational-programme (49, 63), these various programs have different implementation contexts.

Finally, assuming that it is likely impossible to eradicate sports injuries, Guex and Edouard (50, 56) suggested a more positive view of injuries. They suggest looking at what injury risk reduction can bring to sports performance (50, 56). More concretely, these authors insisted on adopting a more resilient and salutogenic approach, which could help to better accept living with this injury risk (50, 56).

Conclusions

Injury can currently be considered an 'inevitable' problem for athletes and their entourage, as well as for all other Athletics-related stakeholders, which can affect their practice and can have consequences on performance and health. Injury is part of the athlete's life, which supports the need to continue the development of injury risk reduction strategies, scientifically evaluate their efficacy, and implement them in daily life.

Conflict of Interest
The authors have no conflict of interest.

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Summary Box

- Injuries currently represent an inevitable problem in athletics, with consequences on athletes' performance and health.
- About two-thirds of athletes had at least one injury during the entire athletics season, and after some years of athletics practice, almost all athletes had experienced at least one injury.
- Injuries can affect athletes, physically, psychologically, and socially, with short- and long-term consequences, potentially affecting musculoskeletal function, athletics performance, athletics career, and resulting in long-term sequelae.
- Some injury risk factors have been described: individual intrinsic (e.g., previous injuries, sex, age) and extrinsic (e.g., discipline, training load).

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