Original Article

Sport Injury and Illness: Surveillance of Tropical Country Athletes during the 1st Winter Children of Asia Games

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Background: The systematic surveillance of injuries and illness in young athletes is important to reduce the loss of training and competition time and enable continuing sports participation. However, the risk and incidence of injury and illness in tropical country athletes competing in winter sports remains unclear.

Objective: To identify the incidence, severity, and causes of injuries and illness in the Thailand National Youth Team during the 10-day First Winter Children of Asia Games.

Materials and Methods: In the present observational prospective cohort study, the authors used the International Olympic Committee (IOC) injury and illness surveillance system for multisport events. The injuries and illnesses of 18 Thailand athletes were collected daily by the team physician over a 10-day competition period.

Results: Eight injuries and nine illnesses were reported, equating to 44.4% of the athletes sustaining at least one injury and 50% at least one illness, an incidence rate of 2.6 injuries and 7.3 illnesses per 100 athletes, respectively. The risk of sustaining an injury was highest during cross country skiing while the most common type of injury was a sprain. The upper respiratory tract was the site most affected by illness with females reporting a greater illness rate.

Conclusion: The presented data constitute the basis for future analyses of injury and illness associated risk factors in winter sports, which are essential to develop and implement effective preventative strategies in tropical winter sport athletes.

Keywords: Surveillance, Injury and illness, Winter sport

Received 21 February 2020 | Revised 13 May 2020 | Accepted 22 May 2020

J Med Assoc Thai 2020;103(11):1116-20
Website: http://www.jmatonline.com

Increased training loads are often imposed on adolescent athletes before full maturation has been achieved[1]. In the presence of greater training stress (mental and physical), potential negative side effects, such as increased incidence of injury and illness, may be encountered[2]. Although sports activities can have many benefits for adolescent athletes, these often result in greater direct and indirect drawback costs for athletes or medical services[1]. Therefore, these factors are a matter of concern for the key stakeholders responsible for athlete well-being. Recently, sports federations have put a greater emphasis on prevention of injuries via the introduction of injury surveillance procedures[3].

Standardized injury surveillance systems detect important epidemiological information, enable long-term monitoring of changes in injury frequency and circumstances, and provide future directions for injury prevention[4]. To date, most of the epidemiological data related to adolescent elite athletes and overuse injuries, have only been collected across specific sport disciplines and not across multi-sport events[5]. In addition, there is little available data from winter athletes that originate from warmer weather, or tropical climates, who often have to simulate their sport-specific training under local conditions. The reduced accessibility to cold weather training facilities, or travel costs to cold weather training camps, suggests that these athletes are less likely to be habituated to cold exposure during major competitions[6]. Indeed, many individual factors, namely recent health status,

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How to cite this article:

Zayar H, Mawhinney C, Kaewkul K, Chaijenkij K. Sport Injury and Illness: Surveillance of Tropical Country Athletes during the 1st Winter Children of Asia Games. J Med Assoc Thai 2020;103:1116-20.

doi.org/10.35755/jmedassocthai.2020.11.11140

physical and mental conditions, acclimatization, fitness, and nutritional status can pose risks to the health of the athletes. This may impact on an athlete's capacity to adequately adapt and safely tolerate a new and demanding environment[7].

Therefore, the authors applied an injury and illness surveillance system to the Thailand National Youth Team to account for all health aspects of elite adolescent athletes during the 2019 First Winter Children of Asia Games.

Objective

The aim of the present study was to identify the incidence, severity, and cause of injuries and illness in the Thailand National Youth Team during the 10-day First Winter Children of Asia Games. It was hypothesized that the environmental change would have a negative effect on athlete health status.

Materials and Methods

The First Winter Children of Asia Games was hosted at an altitude of approximately 1,609 meters at Yuzhno-Sakhalinsk in Sakhalin, Russia, between February 8th and 17th, 2019. During the Games, the average environmental temperature was –8.8°C (range –2°C to –16°C) with a humidity of approximately 80%. Eighty-four athletes from 26 national teams competed in the Games, with only three countries (Thailand, India, and Philippines) originating from a tropical climate. The competitions included eight different sport events, which were figure skating, hockey, short track, skiing, snowboarding, biathlon, ski-racing, and ski-jumping.

In the present study, the authors employed an observational prospective cohort study design by applying the current International Olympic Committee (IOC) injury and illness surveillance system across the events in which the Thailand National Team competed. The participants consisted of 18 athletes (eight males and ten females), aged 15±1.3 years (range 13 to 18 years), who competed in cross country skiing (n=12), figure skating (n=2), and short track (n=4). The athletes were all students who lived and trained in Thailand, thus were not acclimatized to the altitude or environmental temperature. The accreditation number of each athlete and the parents' or guardians' consent was obtained before the release of any medical information. The medical physician of the Thailand National Team collected the number of injuries and illnesses that were reported daily during the 10-day Games.

Definitions of injury and illness

An athlete was defined as injured or ill if he or she received medical attention, regardless of the consequences, which meant the absence from competition or training. The following criteria must have been fulfilled to identify an injury, 1) musculoskeletal complaint or concussion, 2) newly incurred injury or reinjured, 3) incurred in training or competition, and 4) incurred during the First Winter Children of Asia Games[4,6,8,9].

An illness not relating to injury was defined as any physical or physiological problem that received medical attention, which had to occur during the games[6]. Unless there was an exacerbation requiring medical attention, chronic pre-existing illnesses were not included[6].

Data analysis

A summary of incident number, and the severity of injury and illness, were calculated based on the IOC approach. This method corresponded with previous research[3,5,6], which had assessed injury and illness in large international competitions. The present study employed the IBM SPSS Statistics software, version 23.0 (IBM Corp., Armonk, NY, USA) for all statistical analysis. Chi-square tests or Fisher's exact tests were used to examine the association between gender, event, and number of injuries and illnesses.

The present study was approved by the Mahidol University Central Institutional Review Board (COA No. MU-CIRB 2019/011.1601).

Results

Out of the 18 Thai athletes who competed in three out of the seven Winter Olympic Sports during the Games, eight injuries and nine illnesses were recorded. The most injured body part was the ankle joint, accounting for 37% of all injuries, and upper respiratory tract infection was the most common type of athlete illness, accounting for 67% of the total number illnesses.

Rate of injuries and illness

The incidence of illnesses among the Thailand athletes was slightly higher than the incidence of injuries and equated to an incidence of 2.6 injuries and 7.3 illnesses per 100 athletes, respectively. The injuries that occurred accounted for 50% of the total injury rate in training and 50% of the total injury rate in competition (Table 1). The injury and illness incidence rates varied by the type of sport, with cross-country skiing the most common type of sport

Table 1. Number and incidence (percentage) of injuries and illnesses by sport within the Thailand national team

Types of sport	Athletes per sport	Injuries		Athletes injury	Injury incidence (%)	Illnesses	Athletes ill	Illness incidence (%)
		Training	Competition					
Cross country skiing	12	4	2	6	50.0	9	9	75.0
Figure skating	2	-	-	-	-	-	-	-
Short track	4	-	2	2	50.0	-	-	-
Total	18	4	4	8	44.4	9	9	50.0

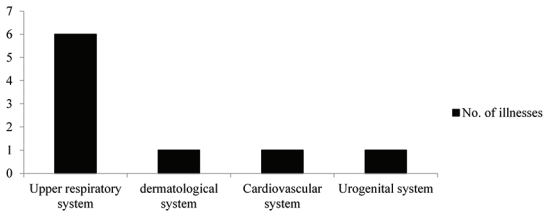

Figure 1. Number of illnesses by affected system.

for encountering injury and illness during the Games (Table 1). The prevalence of injury was significantly higher in females compared with males, with 35% of female athletes injured compared with 6% of male athletes, odds ratio (OR) 5.6 (95% CI 0.76 to 40.95, p=0.04). The incidence of illness was not significantly different between males and females, with 30% of female athletes suffering an illness compared with 19% of males, OR 1.6 (95% CI 0.47 to 5.42, p=0.4).

Nature of injury

An equal number of injuries were recorded in training and competition [4 injuries=50% of all injuries in training, and 4 injuries=50% of all injuries in competition (Table 1)]. The identification of injury by individual anatomical location showed that the foot and ankle were the most commonly injured body part (37% of all injuries), followed by the knee (25% of all injuries), the shoulder, and the hip and thigh (12% each). Non-contact injury, such as falling or slipping, was the most common factor associated with injury (50% of all injuries), followed by overuse (25% of all injuries).

Nature of illness

The most common athlete illness within the Thailand team was upper respiratory related, causing 67% of all illnesses (Figure 1). This was followed by dermatological, cardiovascular, and urogenital (11% of each) illness. The most common cause of illness was upper respiratory tract infection (67%) (Figure 1).

Discussion

The purpose of the present study was to investigate the injury and illness incurred within the Thailand National Team during the First Winter Children Asia Games 2019. This was the first time that young Thai athletes had participated in a winter sport tournament, therefore the present study also investigated the effect of the environmental change on the athletes' health status. The main findings were 1) the lower limb, especially the ankle, was the most injured body region, accounting for 37% of all injuries, 2) the most common illness was related to the upper respiratory tract system, and 3) females had a 5.6 times greater OR of sustaining an injury during the games.

In the present study, the athletes had an incidence of 2.6 injuries and 7.3 illnesses per 100 athletes, respectively. This injury incidence is lower than previously reported[2,3,5,6], however illness occurrence was similar with past observations. In the First Winter Youth Olympic Games in Innsbruck 2012, 10.8 injuries and 8.4 illnesses per 100 athletes were recorded[6]. Similarly, comparable numbers were found in the Second Winter Youth Olympic Games held in Lillehammer 2016, with 9.5 injuries and 7.2 illnesses per 100 athletes recorded, respectively[5,6]. The disparity in injury incidence of the present study findings may be related to the relatively small sample size. It is possible that the negative physiological response to cold weather conditions (non-habituation), may have led to a small increase in injury in the Thai young athletes. However, this is difficult to ascertain. The data also showed that female athletes had a 5.6 times greater odds risk of sustaining an injury, suggesting that females could be more susceptible to injury when competing in cold conditions. Unfortunately, the small sample size (number of athletes in the national team) does not make it possible to directly infer the existence of this gender effect upon injury. Therefore, future work may use larger sample sizes to investigate whether a gender difference is associated with injury risk in

tropical country athletes competing in cold conditions.

The method of data recording, which involved the team physician collecting injury and illness data daily over the 10 days, likely enabled the young athletes to report their health issue as requiring medical attention. The current data support this theory since 25% of all injuries and 22.2% of all illnesses met the time loss definition. Non-contact injuries, such as falling or slipping, were the most common cause of injury, with the foot and ankle the most injured anatomical location. It may be speculated that this was due to being adapted to an artificial snow, rather than an actual snow environment, when conducting training in Thailand.

Lower extremity injuries were the most common type of injury, likely due to the sports placing a high demand on the lower limbs. The present finding is similar to past observations at the Sochi 2014 Winter Olympic Games[3], which found that Team Great Britain (GB) athletes sustained 46% of all injuries to the lower limbs. Out of the three events that the Thai youth athletes registered to compete, cross-country skiing incurred the greatest number of injuries and illnesses during the Games. Due to the nature of the sport, cross country skiing is performed over a relatively long duration outdoors, exposing the athlete to extreme cold weather and strong winds, relative humidity, and radiation[10]. During outdoor practice, this can result in younger athletes being at greater risk of hypothermia compared with adults due to differences in body composition and anthropometry[10]. The primary physiological responses to the cold conditions, peripheral vasoconstriction, and shivering[11], provides thermogenesis to replace body heat loss and maintain core temperature[12]. However, prolonged cold exposure and associated shivering can lead to increased fuel utilization, inducing premature fatigue and impaired performance when exercising in the cold. Therefore, only by speculation, the higher prevalence of injury and illness in cross country skiing athletes, may have partly been related to the greater exposure (and non-habituation) to the cold conditions, possibly resulting in the athletes becoming easily fatigued and potentially more at risk of injury.

The impact of athlete illness on training and competing may have had a direct effect on athletic performance during the Games. Indeed, illness was reported among 50% of the athletes in the Thailand team. The most commonly affected system was the upper respiratory tract, with cross-country skiing the only sport related to causing this illness. The authors' data are in line with previous studies during the previous Winter Youth Olympic Games[5,6]. Similarly, the present findings are also in agreement with others[3] who found respiratory illness to account for 45% of all illnesses in Team GB, albeit in adults. It has been suggested that repeated exposure to cold air during sports, likely exposes athletes to an increased risk for upper-respiratory-tract infections[8,9].

A limitation of the present study was the relatively small sample size in which the surveillance of injury and illness was conducted upon. This was somewhat out of the control of the researchers due to the small number of athletes in the national team. However, this led to an increased practitioner to athlete ratio increasing the likelihood of accurate data collection, with the team physician having access to the athletes daily. Nevertheless, it is not possible to view the present study as truly epidemiological in nature. Finally, it could be argued that athletes could have competed with a minor injury (e.g., strain) or illness without consulting the medical team. In future work, it is recommended that athletes also self-report any related issues, to ensure complete documentation of injury and illness in the absence of athletes not directly seeking medical assistance.

Conclusion

During the First Winter Children of Asia Games, 44% and 50% of Thailand Team Athletes were injured or ill, respectively. Most issues resulted in medical attention, with cross-country skiing (an outdoor sport) found to be the sport that incurred the highest incidence of injury and illness in the Thailand team. Although difficult to ascertain, the physiological responses of tropical country athletes who partake in winter sport may be impaired under cold environmental conditions. Future research addressing the potential mechanisms related to the impairment of athletic performance and physiological changes of athletes who originate from tropical climates and compete in cold weather conditions, are therefore warranted.

What is already known on this topic?

In the Youth Olympic Games, the IOC injury and illness report form is a standardized injury and illness surveillance procedure.

What this study adds?

There has not been a specific injury and illness report for tropical countries in the Youth Winter Games. Despite the limited number of competing athletes, this study may contribute to future injury and

illness prevention strategies for young elite winter sport athletes.

Conflicts of interest

The authors declare no conflict of interest.

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