INCIDENCE, PATTERNS AND RISK FACTORS OF INJURY & ILLNESS AMONG ATHLETES DURING THE MALAYSIAN HIGHER EDUCATION GAMES (SUKIPT) 2018

Muhammad Harith R[1], Mohamad Shariff AH[1].
[1]Department of Sports Medicine, Faculty of Medicine, University Malaya, Kuala Lumpur, Malaysia

Correspondence:
Dr Muhammad Harith Rosdi
Department of Sports Medicine, Faculty of Medicine
University Malaya, 59100 Kuala Lumpur, Malaysia
Phone number (office): +60379498065
Email: harithrosdi@gmail.com

Abstract

Background: Despite regularly participating in international and national level multisport events, there is still limited data on the pattern of injuries and illnesses and factors associated with injuries and illnesses in Malaysia. Such information is crucial to instil preventive measures because sustaining injuries during competition could hamper the athlete's performance.

Methods: This cross-sectional study investigated the incidence, patterns and risk factors of injuries and illnesses among athletes throughout SUKIPT 2018, from the 2nd to the 10th of February 2018. All injuries and illnesses treated by tournament medical personnel were reported using a standardised online injury reporting form. This form was adapted from the injury surveillance form used by the International Olympic Committee.

Results: A total of 6071 athletes from 80 contingents took part in SUKIPT 2018. During the nine days of competition 323 injuries and 48 illnesses were reported, resulting in an incidence of 5.3 injuries and 0.8 illness per 100 athletes. Approximately 6% of the athletes sustained at least one injury or illness.

Conclusion: In summary, the incidence of injuries and illnesses among athletes during SUKIPT was 5.3 and 0.8 per 100 athletes, respectively. Muscle strain/rupture/tear was the most common pattern of injury while collision with another athlete was the most frequent mechanism of injury. Meanwhile, the respiratory system was the most commonly affected by illness and infection was the most prevalent cause of illness.

Keywords: *Athlete, Epidemiology, Injury, Illness, Tournament*

Introduction

Despite the benefits of sports on physical and psychological health, injuries are common and are becoming a burden to both athletes and society (1-5). Therefore, an effective prevention program is crucial, and the first step is to develop a systematic sports injury and illness surveillance (6-7).

Acknowledging the importance of injury surveillance, sports federations such as *Fédération Internationale de Football Association* (FIFA) initiated a longitudinal injury surveillance program at all international tournaments since 1998 (8). This was then initiated in other sports, such as athletics and rugby (9-10). However, these early injury surveillance programs focused on sport-specific events.

For multi-sport events, the International Olympic Committee (IOC) first started conducting injury surveillance during the Athens Olympic Games in 2004. At the Vancouver 2010 Winter Olympic Games, illness was included in the surveillance program. The injury and illness incidences in the Olympic Games range from 9.6 to 14.0 and 5.4 to 8.9 per 100 athletes, respectively (11-17).

Regionally in South East Asia, literature on injury surveillance during a multi-sport event is limited. During the 2008 Thailand National Games, surveillance was done on injury incidence but not on illness (18). In 2016, A Hamid et al. reported the incidence of injuries and illness during the 2014 Asian Games but only studied Malaysian athletes (19).

In Malaysia, despite organising many international and national level multi-sport events such as, the South East Asia (SEA) Games and the Malaysian Games, there is yet no study on injuries and illnesses at these events.

The Malaysian Higher Education Games (SUKIPT) is the largest sporting event at a higher institution level in Malaysia, involving students from public and private universities throughout Malaysia and neighbouring countries. SUKIPT is organised biennially by the Ministry of Higher Education (MOHE) since 2012. SUKIPT 2018 was held from the 2nd to 10th February 2018, hosting 80 contingents, including nine from neighbouring countries, competing in 27 events (20).

The main objective of this study was to describe the incidence and patterns of injuries and illnesses affecting the athletes during SUKIPT 2018. Also, factors associated with injuries were explored. Findings from this study will be used for continuous improvement efforts in providing better care for athletes' health and well-being at future multisport events.

Materials and Methods

Study design

We performed a cross-sectional study on injuries and illnesses sustained by athletes during SUKIPT 2018.

Participants

All athletes registered for SUKIPT 2018 were eligible to take part in this study. Participation was voluntary. Verbal and written informed consent was obtained from participants before participation.

Details of the study, including objectives and procedures involved, were distributed to the *Chef de mission* (CDM) of participating contingents one month before the event.

Data collection

All injuries and illnesses reported to the SUKIPT medical personnel (physiotherapists, staff nurses, medical assistants and doctors), whether on-field (including training and competition) or at the SUKIPT medical centre, were recorded using a standardised injury and illness online report form (Appendix A). This form was adapted from the one used by A Hamid et al. in 2016 and Soligard et al. in 2017 (11,19).

Implementation

Two weeks before the event, a medical coverage seminar was organised involving all SUKIPT medical personnel. They were briefed about the study and guided on how to fill up the form. Leaders of the medical team for each sporting venue were reminded about continuous reporting throughout the event.

Definition of injury and illness

Injuries and illness were defined as new (pre-existing or not fully-recovered conditions were not recorded) or recurrent (athletes having returned to full participation after the previous condition) musculoskeletal complaints (including concussion) or medical illness occurred during training or competition during SUKIPT 2018 (2-10 February 2018) receiving medical attention, regardless of the consequences of the athlete's absence from competition or training (13). In cases where athletes sustained multiple injuries or multiple body parts were affected, only the most severe diagnosis was documented, as determined by our research team (13).

Confidentiality and ethical approval

All information was treated confidentially and individuals de-identified in the injury/illness database after the event. This study was approved by the Medical Ethics Committee of the University Malaya Medical Centre (MECID No: 201819-5947).

Data analysis

Injury and illness incidences (*i*) were calculated according to the formula $i=n/e$, where n is the number of injuries or illnesses in competition, training or in total during the study period and e is the corresponding number of exposed athletes, with incidence proportions presented as injuries/illnesses per 100 athletes. Additionally, the summary measures of injury and illnesses per 1000 athlete-days were calculated where athlete-days correspond to the total number of athletes multiplied by nine days (11).

Results

Demographic characteristics of participants

In total, 6071 athletes took part in SUKIPT 2018. Of these, 3825 (63.0%) were men and 2246 (37.0%) women. The median age of athletes was 21 years old. There were 59 athletes who competed in more than one sport (double-starters), giving a total of 6130 athlete exposures to injury or illness.

Injuries overall

A total of 323 injuries were recorded during the event, equalling to 5.3 injuries per 100 participating athletes, corresponding to 5.9 injuries per 1000 athlete-days. The majority of injuries recorded (82.7%, n=267) were new injuries, with most occurring during the competition (92.1%, n=246).

Location and type of injuries

The most commonly injured anatomical locations were the ankle (n = 39), thigh (n = 39), hand/finger/thumb (n = 39), knee (n = 36) and face (n = 31). The most common injury diagnosed were muscle strain/rupture/tear (n = 75), ligament sprain/rupture (n = 71), bruise/contusion/haematoma (n = 63), and abrasion/laceration/skin lesion (n = 43). The distribution of injury locations and injury types for each sport are presented in Table 1 and 2.

Table 1: Anatomical locations of injury during SUKIPT 2018. (Values are number of injuries)

Sport	Athlete	Anatomical locations																						
		Abdomen	Achilles tendon	Ankle	Buttock / Sacrum / Pelvis	Elbow	Face	Foot / Toe	Forearm	Groin	Hand / Finger / Thumb	Head	Hip	Knee	Lower back / Lumbar spine	Lower leg	Neck / Cervical spine	Shoulder / Clavicle	Sternum / Rib	Thigh	Upper arm	Upper back / Thoracic spine	Wrist	Total
Archery	170										1										1		1	3
Athletics	511			2			2	1						1	2	3		1		12	1			25
Badminton	330			2							1			1						1				5
Bowling	169								2		3									1	1		1	8
Fencing	65							1			2			2								1		6
Football	409			8			2				1			3	2	2			1	2				21
Golf	63																						1	1
Hockey	296						1		1		6			1						2				11
Karate	250	1		4		1	6	4	1		3	1	1	5		3		1	2	4		1		38
Mountain bike	62													1					1					2
Netball	274			2				1							1	2								6
Petanque	244		1	1			1				2			1									1	7
Rugby	431	3		7			6		3		6	3		11	1	1		8	2	2		1		54
Sepak Takraw	135														1					1				2
Silat	358			3	1	2	6	6	1	2	6	3		1	2	1	3	4		1	2		3	47
Softball	314			1		1								1	1			1		3				8
Squash	73																				1			1
Table Tennis	213															1				1				2
Taekwondo	379			5			7	4	1		6	2		6	3	4	2		1	3			3	47
Tennis	135		2	3		1										1		5		5		4	1	22
Volleyball	497			1							2			2				1		1				7
TOTAL	6130	4	3	39	1	5	31	17	9	2	39	9	1	36	13	18	5	21	7	39	6	7	11	323

No injury was reported in swimming, shooting, lawn bowls, cricket, chess and beach volleyball.

Table 2: Injury types during SUKIPT 2018. (Values are number of injuries)

Sport	Athlete	Types of injury												
		Abrasion Laceration Skin lesion	Bruise Contusion Hematoma	Concussion Head injury	Dislocation Subluxation	Fracture (suspected, traumatic)	Lesion of meniscus or cartilage	Ligament sprain	Muscle cramp or spasm	Muscle strain, rupture, tear	Spinal cord, nerve injury	Tendinosis Tendinopathy	Other	Total
Archery	170	1	1							1				3
Athletics	511	2				2		2	2	14	1	2		25
Badminton	330	2						2		1				5
Bowling	169		2						2	4				8
Fencing	65	2	2					2						6
Football	409	3	2			1		10		5				21
Golf	63									1				1
Hockey	296	7	1				1		2					11
Karate	250	8	6	1		2		9		12				38
Mountain bike	62	1			1									2
Netball	274		1					2		1			2	6
Petanque	244	2				1		2		1		1		7
Rugby	431	5	7	2	4	1	1	21	2	10			1	54
Sepak Takraw	135									2				2
Silat	358	5	16		3	5		9		6		2	1	47
Softball	314				1			1		4		2		8
Squash	73									1				1
Table Tennis	213								1	1				2
Taekwondo	379	2	22	1	2	6	1	7	1	2		3		47
Tennis	135	1						3	6	9		3		22
Volleyball	497	2	3					1	1					7
TOTAL	6130	43	63	4	11	18	3	71	17	75	1	13	4	323

No injury was reported in swimming, shooting, lawn bowls, cricket, chess and beach volleyball.

Cause, mechanism and onset of injuries

The majority of injuries were due to trauma (n = 234, 72.4%) with the remaining 27.6% (n = 89) being associated with overuse. The three most frequently-reported injury mechanisms were collision/contact with another athlete (50.8%), overuse (25.7%) and non-contact trauma (12.7%). The distribution of injury mechanisms in each sport is detailed in Table 3.

Table 3: Injury mechanisms during SUKIPT 2018. (Values are number of injuries)

Sport	Athlete	Injury Mechanisms/Causes								
		Collision / contact with another athlete	Collision / contact with moving object (e.g. ball)	Collision / contact with stagnant object (e.g. pole)	Field of play conditions	Non-contact	Overuse (gradual onset)	Overuse (sudden onset)	Recurrence of previous injury	Total
Archery	170		2			1				3
Athletics	511		1			7		13	4	25
Badminton	330		1			3		1		5
Bowling	169					1	3	4		8
Fencing	65		3		1		1	1		6
Football	409	9			1	5		4	2	21
Golf	63						1			1
Hockey	296	1	2		1	5	2			11
Karate	250	23	1	1		2	4	6	1	38
Mountain bike	62			1		1				2
Netball	274	1				3	2			6
Petanque	244		2			2		2	1	7
Rugby	431	45			1	3		2	3	54
Sepak Takraw	135						1	1		2
Silat	358	43				2		2		47
Softball	314			1		1	1	5		8
Squash	73							1		1
Table Tennis	213							2		2
Taekwondo	379	40				3	2	2		47
Tennis	135			1		2	3	11		22
Volleyball	497	2	2		1			1	1	7
TOTAL	6130	164	14	4	5	41	20	63	12	323

No injury was reported in swimming, shooting, lawn bowls, cricket, chess and beach volleyball.

Injuries by gender, sport and severity

The injury incidences for men (5.6 injuries per 100 athletes) and women (4.9 per 100 athletes) were comparable ($p > 0.05$).

The incidence of injuries in different sports is depicted in Table 4. Overall, contact sports, including combat sports (silat, taekwondo and karate) and rugby, made up the majority of injuries reported (n = 186, 57.6%). When injuries were reported in relation to the number of registered athletes (per 100 athletes), the rate of injury was highest in tennis (16.3), followed by karate (15.2), silat (13.1), rugby (12.5) and taekwondo (12.4).

More than half (n = 186, 57.6%) of the injuries resulted in no time loss from sport while the remaining (n = 137, 42.4%) prevented athletes from sports participation at least for one day (Table 4). Approximately 24.5% (n = 79) of the injuries were mild, resulting in an absence from sports from 1 to 7 days. Only 58 injuries (18.0%) were classified as severe, with an estimated absence from training or competition of more than 1 week (Table 4). These severe injuries included fracture (n = 14), ligament sprain (n = 13), tendinosis / tendinopathy (n = 12), muscle strain / rupture / tear (n = 11), bruise / contusion / hematoma (n = 9), dislocation / subluxation (n = 7), concussion (n = 1) and knee meniscus injury (n = 1).

Table 4: Proportions of athletes (%) in each sport with injury, injury with estimated time loss ≥1 day, and injury with estimated time loss >7 days

Types of sports	No. of participating athletes	No. of injuries	Incidence rate (per 100 athletes)	Gender		Severity		
				M	F	No time loss	Mild (≤7d)	Severe (>7d)
Tennis	135	22	16.3	19	3	20	-	2
Karate	250	38	15.2	27	11	25	8	5
Silat	358	47	13.1	34	13	17	20	10
Rugby	431	54	12.5	41	13	37	9	8
Taekwondo	379	47	12.4	25	22	20	14	13
Fencing	65	6	9.2	4	2	6	-	-
Football	409	21	5.1	21	-	9	6	6
Athletics	511	25	4.9	16	9	11	6	8
Bowling	169	8	4.7	5	3	7	1	-
Hockey	296	11	3.7	7	4	10	-	1
Mountain bike	62	2	3.2	-	2	1	-	1
Petanque	244	7	2.9	1	6	4	3	-
Softball	314	8	2.5	2	6	2	4	2
Netball	274	6	2.2	-	6	2	4	-
Archery	170	3	1.8	-	3	1	1	1
Golf	63	1	1.6	1	-	1	-	-
Badminton	330	5	1.5	4	1	2	2	1
Sepak Takraw	135	2	1.5	2	-	2	-	-
Volleyball	497	7	1.4	3	4	7	-	-
Squash	73	1	1.4	1	-	-	1	-
Table Tennis	213	2	0.9	1	1	2	-	-
TOTAL	6130	323		214	109	186	79	58

No injury was reported in swimming, shooting, lawn bowls, cricket, chess and beach volleyball.

Illnesses overall

Among the 6071 participating athletes, a total of 48 illnesses were reported, corresponding to 0.8 illnesses per 100 athletes or 0.9 illnesses per 1000 athlete-days.

Affected system and cause of illnesses

Infection was the most common cause of illness (n = 25, 52%). A total of 23 illnesses (48%) affected the respiratory system, followed by heat-related illness (n = 8, 16.7%) and the digestive system (n = 5, 10.4%) (Table 5).

Illnesses by gender, sport and severity

Incidence of illness in women (1.2 illness per 100 athletes) doubled the incidence in men (0.6 illness per 100 athletes).

The incidence and severity of illnesses in different sports are shown in Table 6. Mountain bike cyclists had the highest incidence of illness (3.2 illnesses per 100 athletes), followed by lawn bowls (2.7), petanque (2.5) and athletics (2.0). One-third of the illnesses (n = 16, 33.3%) resulted in absence from training or competition for at least one day. Of these, four illnesses (8.3%) resulted in an estimated time loss of more than seven days (chickenpox, conjunctivitis, pneumonia and heat-related illness with dehydration).

Discussion

This is the first injury surveillance study conducted during a multi-sport event in Malaysia. Additionally, this is the first study that describes both injury and illness among athletes participating in a multi-sport event in South East Asia. Similar studies conducted during the previous summer Olympic Games (Rio 2016, London 2012 and Beijing 2008), the 2013 Cali World Games and the 2008 Thailand National Games, are used for comparison (11,13,15,18,21).

Injuries

Injury incidences

The incidence of injury during SUKIPT (5.0%) was lower than the rate reported in the previous summer Olympic Games (9.6 – 12.9%). This could be attributed to the larger number of athletes and higher level of competitiveness of

Table 5: Affected system by illnesses during SUKIPT 2018. (Values are number of injuries)

Sport	Affected system by illness								
	Respiratory problem	Gastrointestinal problem	Heat related illness	Dermatologic	Allergic / Immunological	Urogenital / Gynaecological	Metabolic	Other	Total
Archery						1			1
Athletics	4	2	4						10
Chess	2								2
Cricket	2								2
Football	1		1						2
Karate								1	1
Mountain bike	1	1							2
Netball	1			1				1	3
Petanque	3				2			1	6
Rugby			1			1	2		4
Silat		1						1	2
Softball	3						1		4
Table Tennis	1								1
Taekwondo	2		1						3
Tennis	1								1
TOTAL	21	4	7	1	2	2	3	4	48

No illness was recorded in 11 sports including swimming, shooting, beach volleyball, squash and volleyball.

Table 6: Proportions of athletes (%) in each sport with illnesses, illnesses with estimated time loss ≥1 day, and illnesses with estimated time loss >7 days

Types of sports	No. of participating athletes	No. of illnesses	Incidence rate (per 100 athletes)	Severity		
				No time loss	Mild (<7d)	Severe (>7d)
Mountain bike	62	2	3.2	1	1	0
Lawn bowls	149	4	2.7	3	1	0
Petanque	244	6	2.5	5	1	0
Athletics	511	10	2.0	3	6	1
Cricket	134	2	1.5	2	0	0
Softball	314	4	1.3	3	0	1
Netball	274	3	1.1	1	0	2
Rugby	431	4	0.9	4	0	0
Chess	219	2	0.9	1	1	0
Taekwondo	379	3	0.8	3	0	0
Tennis	135	1	0.7	1	0	0
Silat	358	2	0.6	0	2	0
Archery	170	1	0.6	1	0	0
Football	409	2	0.5	2	0	0
Table Tennis	213	1	0.5	1	0	0
Karate	250	1	0.4	1	0	0
TOTAL	6130	48		32	12	4

No illness was recorded in 11 sports including swimming, shooting, beach volleyball, squash and volleyball.

the Olympic Games. There were more than 10000 athletes who participated in the last three summer Olympic Games, almost double the number of athletes during SUKIPT (11,13,15).

The incidence of injury in this study is comparable to the rate reported at Thailand National Games (4.0%) and Cali Games (3.1%) despite differences in the number of athletes between these three events. [18, 21] SUKIPT was dominated by male athletes where almost two-thirds were men (63% men vs 37% women). In contrast, distribution of athletes in other studies was relatively balanced (55% men vs 45% women) (11,13,15,18,21). Our study found that the incidence of injuries between genders was comparable and this is consistent with the findings at the Rio Games and London Games (11,13).

In SUKIPT, the majority of injuries occurred in contact sports (combat sports and rugby). This finding is consistent with that reported at the Thailand National Games (18). However, it contradicted the findings during the London and Beijing Games, which reported that the majority of injuries occurred in non-contact sports (athletics) (13,15). This could be due to the higher percentage of athletes participating in contact sports during SUKIPT (23.3%) and Thailand Games (22.1%) compared to London Games (10.7%) and Beijing Games (10.3%) (13,15,18).

Severity and onset of injuries

Less than half of injuries in SUKIPT resulted in time loss from competition or training of at least one day (42.4%). Similar findings were reported during Rio Games, London Games and Beijing Games (11,13,15). In contrast, at the Cali Games the majority (85.0%) of the injuries resulted in time loss (21). Unfortunately, there was no explanation given by Llinas et al. for this difference and no information is available on the types of injury and illness leading to the most time loss (21). Out of all injuries that resulted in time loss, our study reported slightly lower incidence (18.0%) of severe injuries (defined as an injury that results in time loss more than seven days) compared to the Rio Games (20.0%) (11). In terms of injury onset, all these studies reported more injuries during competition than in training (11,13,15,18,21). It could be due to higher playing intensity during the competition that leads to increased aggressiveness and physical contact compared to training (22,23).

Location and type of injuries

During SUKIPT, injuries frequently involved the ankle followed by the thigh and hand/finger/thumb. In contrast, the hand and knee were the most commonly affected sites at both the Cali Games and Rio Games (11,21).

The most common types of injuries were muscle strain/rupture/tear (23.3%) and ligament sprain/rupture (22.0%), and consistent to the those reported in earlier studies (11,13,15,18,21).

Mechanism of injuries

In this study, the most common mechanism of injuries was contact with another athlete. A similar finding was reported at the Rio and Beijing Olympic Games (11,15). In contrast, overuse was the commonest mechanism of injuries during the London Games (13). The differences in the findings were not explained (11). Studies by Bahr and Clarsen et al. suggested that the current epidemiological studies commonly miss overuse injuries in sports as the majority of injured athletes often do not seek medical attention (24,25). Hence, there is a possibility of under-reporting of overuse injury to the medical team during the Games.

Illness risk

The incidence of illness at both the SUKIPT and Cali Games were 1.0 per 100 athletes. This is lower than the rates reported at the Rio Games (5.4) and London Games (7.0) (11,13). As suggested by Llinas et al., the big difference is likely to be attributed to under-reporting of illnesses (21).

Also, Olympic Games gathered a greater number of people from all over the world, thus increasing the risk of spreading infection, especially respiratory tract infection (26-29). This is consistent with findings that the majority of illnesses affected the respiratory system and caused by infection (11-16). In contrast to the injury, more female athletes were ill during all these events (1.2% women vs 0.6% men). A study showed that women are more likely to say they are ill or attend more closely to their symptoms than men (30). It could be postulated that men usually wait longer and will only present their symptoms when they worsen. He et al. also suggested that lower mucosal-immunity associated with training as the most likely reasons for higher upper respiratory tract infection among women (31).

Out of the 42.4% ill athletes during SUKIPT who took at least one-day rest from training or competition, one fifth (20.0%) were rested for more than 7 days (severe case). In contrast, the Rio Games and London Games reported a much lower incidence of severe cases at 0.3% and 6.2%, respectively (11,13).

SUKIPT and all three summer Olympic Games reported that the respiratory system was the site of the most frequent illnesses reported, with upper respiratory tract infection topping the list (11,13,15).

Study limitations

It is believed that the current study captured most injuries and illnesses throughout SUKIPT 2018. However, the current study did not assess the response rate from medical teams despite our effort in getting a daily report from each venue. Under-reporting during this study could be due to two main reasons. It is possible that athletes with a minor injury or illness did not seek medical attention as it did not affect performance (32). This is a common limitation

encountered by previous studies (11,13,21). There were suggestions to conduct retrospective athlete interviews at the end of the event or actively look for injured and ill athletes by distributing questionnaires at accommodations and resting areas (33). Nevertheless, these suggestions seem too ideal and impractical for major multi-sport events like SUKIPT.

Previous studies reported small percentages of missing data especially on injury severity and injury mechanisms (11,13). Additionally, missing physical forms and delayed collection of the forms were also reported. The current study, however, used an electronic online form (Google form) to allow immediate update of data and ensuring completeness of data collection by making all components in the form as required input before submission. However, there are a few limitations in using online forms, which needs to be mentioned. Firstly, it may not be accessible in venues with poor network coverage. During SUKIPT 2018, we did not encounter this issue as all venues had good network coverage. Secondly, medical personnel had to use their mobile phones or tablets to fill up the form. In situations where the phone was not available, it is possible that the online form was not filled and submitted. In the current study physical forms were also provided at each venue in case the online forms became inaccessible/ unavailable.

For future SUKIPT or similar multi-sport events in Malaysia, we recommend the contingent medical teams to monitor injuries and illnesses. This can be achieved by proper communication between tournament and contingent medical teams before the event. This is only possible with cooperation from the event organiser, by making the surveillance official and providing the tournament medical secretariat with contact details of both the *Chef de Mission* and contingent medical officer.

Practical implication

This is the first injury and illness surveillance study conducted during a multi-sport event in Malaysia. It is hoped that the results of this study will serve as a baseline for future studies. Additionally, such information could be useful for future planning on the implementation of prevention programs by national and international sports federations.

Conclusion

In summary, the incidence of injuries and illnesses among athletes during SUKIPT was 5.3 and 0.8 per 100 athletes, respectively. Muscle strain/rupture/tear was the most common pattern of injury while collision with another athlete was the most common mechanism of injury. In addition, respiratory infection was the commonest cause of illness affecting athletes.

How might it impact on clinical practice in the near future?

These injury and illness data can help inform policy and planning bodies of future multi-sport events (e.g., Malaysian Games, SEA Games, Asian Games, Commonwealth Games).

These data can directly indicate the focus and development of injury prevention measures in sport.

Acknowledgement

We thank Assoc. Prof. Dr. Abdul Halim Mokhtar, Dr. Kiran Kandiah and Madam Erna Achbar from the University Malaya for their assistance in planning and implementation of the research. My grateful thanks also extended to all SUKIPT 2018 medical personnel contributing to the data collection.

Competing interests

The authors declare that they have no competing interests.

Financial support

The authors declare that they have no financial support.

References

1. Eime RM, Young JA, Harvey JT, Charity MJ, Payne WR. A systematic review of the psychological and social benefits of participation in sport for children and adolescents: informing development of a conceptual model of health through sport. Int J Behav Nutr Phys Act. 2013;10:98.
2. Reiner M, Niermann C, Jekauc D, Woll A. Long-term health benefits of physical activity - A systematic review of longitudinal studies. BMC Public Health. 2013;13:813.
3. Clarke PM, Walter SJ, Hayen A, Mallon WJ, Hejimans J, Studdert DM. Survival of the fittest: retrospective cohort study of the longevity of Olympic medallists in the modern era. Br J Sports Med. 2015;49:898-902.
4. Ekstrand J, Hägglund M, Waldén M. Injury incidence and injury patterns in professional football: the UEFA injury study. Br J Sports Med. 2011;45:553-8.
5. Finch CF, Kemp JL, Clapperton AJ. The incidence and burden of hospital-treated sports-related injury in people aged 15+ years in Victoria, Australia, 2004-2010: a future epidemic of osteoarthritis? Osteoarthritis Cartilage. 2015;23:1138-43.
6. van Mechelen W, Hlobil H, Kemper HC. Incidence, severity, aetiology and prevention of sports injuries. A review of concepts. Sports Med. 1992;14:82–99.
7. Finch C. A new framework for research leading to sports injury prevention. J Sci Med Sport. 2006;9:3–9.
8. Junge A, Dvorak J. Injury surveillance in the World Football Tournaments 1998–2012. Br J Sports Med. 2013;47:782-8.
9. Alonso JM, Junge A, Renstrom P, Engebretsen L, Mountjoy M, Dvorak J. Sports injuries surveillance during the 2007 IAAF World Athletics Championships. Clin J Sport Med. 2009;19:26-32.
10. Fuller CW, Laborde F, Leather RJ, Molloy MG. International Rugby Board Rugby World Cup

2007 injury surveillance study. Br J Sports Med. 2008;42(6):452-9.
11. Soligard T, Steffen K, Palmer D, Alonso JM, Bahr R, Lopes AD, *et al.* Sports injury and illness incidence in the Rio de Janeiro 2016 Olympic Summer Games: A prospective study of 11274 athletes from 207 countries. Br J Sports Med. 2017;51(17):1265-1271.
12. Soligard T, Steffen K, Palmer-Green D, Aubry M, Grant ME, Meeuwisse W, *et al.* Sports injuries and illnesses in the Sochi 2014 Olympic Winter Games. *Br J Sports Med*. 2015;49(7):441–7.
13. Engebretsen L, Soligard T, Steffen K, Alonso JM, Aubry M, Budgett R, *et al.* Sports injuries and illnesses during the London Summer Olympic Games 2012. Br J Sports Med. 2013;47(7):407-14.
14. Engebretsen L, Steffen K, Alonso JM, Aubry M, Dvorak J, Junge A, *et al.* Sports injuries and illnesses during the Winter Olympic Games 2010. Br J Sports Med. 2010;44(11):772-80.
15. Junge A, Engebretsen L, Mountjoy ML, Alonso JM, Renstrom PA, Aubry MJ, *et al.* Sports injuries during the Summer Olympic Games 2008. *Am J Sports Med*. 2009;37(11):2165–72.
16. Junge A, Langevoort G, Pipe A, Peytavin A, Wong F, Beltrami G, *et al.* Injuries in Team Sport Tournaments during the 2004 Olympic Games. Am J Sports Med. 2006;34(4):565-76.
17. Junge A, Engebretsen L, Alonso JM, Renstrom P, Mountijoy M, Aubry M, *et al.* Injury surveillance in multi-sport events: the International Olympic Committee approach. Br J Sports Med. 2008;42(6):413-21.
18. Laoruengthana A, Poosamsai P, Fangsanau T, Supanpaiboon P, Tungkasamesamran K. The epidemiology of sports injury during the 37th Thailand National Games 2008 in Phitsanulok. J Med Assoc Thai. 2009;92(Suppl 6):S204-10.
19. A Hamid MS, Puji A, Salleh Z, Jamalullail Z, Hussein KH. Patterns of Injuries and Illness Among Malaysian Athletes during the XVII Asian Games 2014. Sains Malaysiana. 2016;45(10):1531–6.
20. Info SUKIPT. http://sukipt.com.my/index.php/en/ (accessed 12 March 2018).
21. Llinás PJ, Serrano RF, Barrera LQ, Noguera JCQ, Cano JPM. Sports injuries and ill-health episodes in the Cali 2013 World Games. BMJ Open Sport Exerc Med. 2016;2(1):e000072.
22. Emery CA, Meeuwisse WH, Hartmann SE. Evaluation of risk factors for injury in adolescent soccer: implementation and validation of an injury surveillance system. Am J Sports Med. 2005;33(12):1882–91.
23. Stuart MJ. Gridiron football injuries. Med Sport Sci. 2005;49:62–85.
24. Bahr R. No injuries, but plenty of pain? On the methodology for recording overuse symptoms in sports. Br J Sports Med. 2009;43(13):966–72.
25. Clarsen B, Myklebust G, Bahr R. Development and validation of a new method for the registration of overuse injuries in sports injury epidemiology: the Oslo Sports Trauma Research Centre (OSTRC) overuse injury questionnaire. Br J Sports Med. 2013;47(8):495-502.
26. Al-Tawfiq JA, Gautret P, Benkouiten S, Memish ZA. Mass Gatherings and the Spread of Respiratory Infections. Lessons from the Hajj. Ann Am Thorac Soc. 2016;13(6):759-65.
27. Tabatabaei SM & Metanat M. Mass Gatherings and Infectious Diseases Epidemiology and Surveillance, Int J Infect. 2015;2(2):e22833.
28. Gautret P & Steffen R. Communicable diseases as health risks at mass gatherings other than Hajj: what is the evidence? Int J Infect. 2016;47:46-52.
29. London Olympics: Enhancing disease surveillance and response. http://www.who.int/csr/mass_gatherings/olympics/en/ (accessed on 28 March 2018).
30. Borrell C, Malmusi D, Muntaner C. Introduction to the "Evaluating the Impact of Structural Policies on Health Inequalities and Their Social Determinants and Fostering Change" (SOPHIE) Project. Int J Health Serv. 2017;47(1):10-7.
31. He CS, Bishop NC, Handzlik MK, Muhamad AS, Gleeson M. Sex differences in upper respiratory symptoms prevalence and oral-respiratory mucosal immunity in endurance athletes. Exercise Immunology Review. 2014;20:8-22.
32. Finch CF. An overview of some definitional issues for sports injury surveillance. *Sports Med.* 1997;24(3):157–63.
33. Alonso JM, Edouard P, Fischetto G, Adams B, Depiesse F, Mountjoy M. Determination of future prevention strategies in elite track and field: analysis of Daegu 2011 IAAF Championships injuries and illnesses surveillance. Br J Sports Med. 2012;46(7):505–14.

Appendix A

SUKIPT 2018 INJURY / ILLNESS FORM

Date : ____/ ____/ ____/

PATIENT'S INFORMATION

Athlete ☐ Official ☐ Other ☐

Male ☐ Female ☐

ID no. : _____

D.O.B : ____/ ____/ ____/

Institution:

_____

Sport & Event (e.g. Football, Athletics-100m men):

_____

Date of injury / onset of illness: ____/ ____/ ____/

Injury occurred during:
☐ Training
☐ Competition

Types of injury / illness:
☐ New
☐ Recurrent
☐ Existing

Was the injury caused by overuse / trauma (for injury)?
☐ Overuse
☐ Trauma (contact & non-contact)

Side of body injured:
☐ Right
☐ Left
☐ Both
☐ Not applicable

Dominant side:
☐ Right
☐ Left

Was protective equipment worn on the injured body part?
☐ Yes
☐ No

Injured body part (e.g. head, knee):

_____

Injury / illness severity assessment:
☐ Immediate return to unrestricted activity
☐ Mild (1-7 days out of play)
☐ Moderate (>1 week out of play)
☐ Severe (>1 month out of play)

Cause of injury / illness:
☐ Overuse (gradual onset)
☐ Overuse (gradual onset)
☐ Non-contact trauma
☐ Recurrence of previous injury
☐ Collision / contact with another athlete
☐ Collision / contact with moving object (e.g. ball)
☐ Collision / contact with stagnant object (e.g. pole)
☐ Violation of rules (e.g. pushing)
☐ Field of play conditions
☐ Weather condition
☐ Equipment failure
☐ Infection
☐ Pre-existing condition (e.g. asthma, allergy)
☐ Environmental
☐ Reaction to medication
☐ Other:

_____

Nature of injury / Affected system for illness:
☐ Concussion/head injury (regardless of LOC)
☐ Fracture (suspected, traumatic)
☐ Stress fracture (suspected, overuse)
☐ Dislocation / Subluxation
☐ Tendon rupture (confirmed by radiology)
☐ Tendinosis / Tendinopathy
☐ Ligament rupture (confirmed by radiology)
☐ Ligament sprain
☐ Muscle strain / rupture / tear
☐ Muscle cramp / spasm
☐ Lesion of meniscus / cartilage
☐ Bruise / contusion / hematoma
☐ Arthritis / synovitis / bursitis
☐ Fasciitis / aponeurosis injury
☐ Abrasion / laceration / skin lesion
☐ Dental injury
☐ Spinal cord / nerve injury
☐ Cardiac problem (for illness)
☐ Respiratory problem (for illness)
☐ Gastrointestinal problem (for illness)
☐ Allergic / Immunological (for illness)
☐ Dermatologic (for illness)
☐ Urogenital / Gynaecological (for illness)
☐ Other:

_____

Provisional diagnosis:

_____

Treatment given:

_____

_____

Name & position of treating medical personnel:

_____

_____

_____