

**Original article**

**Patterns of Injuries and Illness Among Malaysian Contingents  
During the Kuala Lumpur South East Asia (KL SEA) Games 2017**

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**Abstract:**

**Introduction:** Malaysia has participated in many international multi-sport events, but there is limited data on the injury and illness prevalence of the Malaysian contingent.

**Objective:** The purpose of this study was to investigate the pattern of injuries and illnesses among the athletes and officials in the Malaysian contingent during the KL SEA Games 2017.

**Materials and methods:** The medical records of the Malaysian contingent who received medical attention from the Malaysian medical team contingent during the centralised camp and the Games, were retrieved. The Malaysian medical team used a standardised injury and illness reporting form to record clinical and socio-demographic information of the athletes and officials in the Malaysian contingent. **Results and Discussion:** The total number of medical consultations received were 509 and 85.4% were with athletes. Two-hundred two injuries and 238 illnesses were diagnosed among the athletes. The most common injury among the athletes was muscle tears and strains, followed by ligamentous injuries, tendon injuries, bruises, and contusions. Majority of the injuries were mild and occurred during training. Recurrent injuries and increase in athlete's age were significant predictors of injury severity. Comparable to earlier reports, the most common illness among athletes, was the respiratory system, followed by gastroenterology and dermatology. A total of 11 injuries and 58 illnesses were reported among the Malaysian contingent officials. Compared to athletes, the injury rate among the officials was much lower. The illness rate among the officials was half of the athletes' illness rate, even though there was a higher prevalence of underlying chronic diseases among the officials. **Conclusion:** The rate of injuries and illness among Malaysian athletes in the KL Sea Games 2017 was comparable to previous reports. However, the rate of injuries and illness of the officials in the Malaysian contingent was lower compared to athletes.

**Keywords:** injury surveillance; multisport event, sports injuries

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**Introduction**

The South East Asian (SEA) Games is the largest multi-sport event in the South East Asia region. The Kuala Lumpur SEA (KL SEA) Games 2017 saw the largest Malaysian contingent in history since Malaysia participated in an international event. At the KL SEA Games 2017, Malaysia was represented by 845 athletes (470 male, 375

female) and 390 officials making it a total of 1235 people. It is well known that major sports events such as the SEA Games are associated with the risk of injuries and illnesses for athletes and officials<sup>1</sup>. Surveillance of injuries and illnesses is important to ensure the health and wellbeing of contingent's athletes and officials<sup>2</sup>.

Malaysia has been participating in multi-sport

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events since the 1964 Olympic Games, but there is limited data on the injury and illness prevalence of the Malaysian contingent. At present, there are only two studies that investigated the pattern of injuries and illness among Malaysian athletes participating at multisport events. The first study reported injury and illness prevalence at the 1972 Olympics held in Munich, Germany<sup>3</sup>. The second study was conducted during the 2014 Asian Games held in Incheon, South Korea<sup>4</sup>. Both studies only included a small number of sports and athletes who managed to qualify for the Olympic (n=57) and the Asian Games (n=276).

Contingents officials, including team managers, coaches, support staff, and medical staff play a vital role in supporting athletes to perform at their best at these events. During the Games, officials are also in close proximity to athletes at the Games Village and competition venues. In the event of acute infections, both officials and athletes can spread and be at risk of becoming infected. Yet the prevalence of injury and illness among officials is limited<sup>5</sup>. Information on the type of medical services needed and utilised, is essential for the contingent medical team planning especially in resources management of medical supplies, medications, and medical staff<sup>5</sup>.

The aim of this study was to investigate the pattern of injuries and illnesses among the Malaysian contingent during the KL SEA Games 2017. Apart from providing information on factors associated with injury and illness occurrence, findings from this study could be useful for injury and illness preventive strategies. Additionally, information gathered from this study could guide future planning of resources for the Malaysian medical team contingent<sup>6</sup>.

## **Materials and Methods**

### ***Data Collection***

This was a cross-sectional retrospective study. The medical records of the Malaysian contingent who received medical attention from the contingent's medical team from the first day of the contingent centralised camp (4<sup>th</sup> August 2017) until the final day of the 2017 KL SEA Games (30<sup>th</sup> Aug 2017) were retrieved. The Malaysian medical team, composed of medical personnel (doctors, assistant medical officers, physiotherapists, and staff nurses), were stationed at all competition venues and accommodations. The Malaysian medical team used a standardised injury and illness reporting form adapted from the International

Olympic Committee (IOC) daily report form<sup>7</sup>. All personnel in the Malaysian medical team had a half-day training workshop on the usage of the standardised report form.

The injury report form (Appendix 1) comprises information on sociodemographic such as name, identification number, age, contact number, gender, and sports. Information on the time of the consultation, history of allergies or the presence of underlying medical illness were documented. Information related to injury and illness including the presenting complaint (injury mechanism), clinical examination, diagnosis, and the treatment plan were retrieved.

### ***Definition of Injury and Illness***

Injuries and illnesses were defined as any musculoskeletal complaints, or medical conditions (including concussions) that require medical attention at training or competition, regardless of the consequences whether absence from competition or training<sup>8</sup>. Injuries and illness were also categorised as new or recurrent (athletes which have returned to full participation after the previous injury). For multiple injuries or injuries affecting multiple body parts, documentation will be done only on the most severe diagnosis<sup>8</sup>.

### ***Data Analysis***

Injuries and illnesses recorded for athletes and officials were analysed separately. Continuous variables were reported as mean  $\pm$  SD or median  $\pm$  IQR based on data distribution assessed using the Shapiro-Wilk test of normality. Categorical variables were expressed as frequencies (numbers) and prevalence (%).

The injury and illness prevalence were calculated according to the formula, prevalence = the number of injuries or illness divided by the number of all athletes and officials in the national contingent participating in the KL SEA Games 2017<sup>9</sup>. The injury and illness rate were reported per 100 athletes or officials. Factors associated with injuries and illnesses were investigated. Injuries sustained by athletes were broken down according to sports where appropriate. Injury severity was classified into mild (<7 days off sports), moderate (7 – 28 days off sports) and severe (more than 28 days off sports) based on time away from participation.

The Chi-square test was used to investigate the association between injury severity and age, gender, type of injury (new or recurrent), mechanism of injury (contact or non-contact), time

of injury (training or competition), and body region injured. Stepwise logistic regression analysis was conducted to identify predictors of injury severity. Variables with  $p < 0.25$  on univariate testing were included in the multivariate logistic regression model, as recommended by previous researchers<sup>10,11</sup>. All analyses were conducted using the Statistical Package for the Social Sciences (SPSS) version 25.0 (SPSS Inc., Chicago, IL, USA), with a significance level set at  $p < 0.05$ .

## Results

The Malaysian contingent was represented by 845 athletes and 390 officials, making a total of 1235 delegates at the KL SEA Games 2017. The KL SEA Games was held from the 19<sup>th</sup> of August until 30<sup>th</sup> August 2017. The total number of medical attentions received by Malaysian athletes and officials was 509. Majority ( $n=440$ ; 85.4%) of medical consultations were with athletes (Table 1).

**Table 1.** Distribution of Malaysian contingent athletes and officials who received medical attention during the KL Sea Games 2017

	Athletes (%)	Officials (%)
Consultation	440 (85.4)	69 (14.6)
Gender		
Male	216 (49.1)	44 (63.8)
Female	224 (50.1)	25 (36.2)
Age (Median $\pm$ IQR) years	22.0 $\pm$ 8.0	40.0 $\pm$ 14.0
Injury	202 (23.9)	11 (2.8)
Illness	238 (28.2)	58 (14.9)

IQR=interquartile range

Since athletes and officials have different demographic backgrounds, roles, and health status, data analysis was performed separately. Out of the 845 Malaysian athletes who participated in the games, 440 medical consultations were recorded. Seven athletes reported underlying medical conditions with six having bronchial asthma and one with a G6PD deficiency.

Four officials reported pre-existing hypertension ( $n = 2$ ), bronchial asthma ( $n = 1$ ). One official found to have a history of ischemic heart disease, hypercholesterolemia, hypothyroidism, gouty arthritis, and hypertension.

Two-hundred two injuries and 238 illnesses were diagnosed throughout the duration of the Games, representing an overall injury and illness rate of 23.9 and 28.2 per 100 athletes, respectively. Among the athletes who sought medical attention,

50.1% were female. The median age of athletes who received medical attention was 22.0 $\pm$ 8.0 (IQR) with age ranges from 11 to 45 years old.

On the other hand, a total of 69 medical consultations was reported among Malaysian contingent officials. Among these, 11 injuries and 58 illnesses were diagnosed, representing injury and illness rates of 2.8 and 14.9 per 100 officials respectively. Majority of the officials who received medical consultations were male (63.8%). The mean age of officials who received medical attention was 40.3 $\pm$ 10.2 (SD) with age ranges from 21 to 63 years old.

## *Injury rate and distribution of injuries among athletes*

Out of the 202 injuries diagnosed, 129 (78.7%) athletes sustained at least one injury, 32 (19.5%) athletes sustained two injuries and 3 (1.8%) athletes sustained more than 2 injuries. The highest number of injuries was diagnosed among volleyball players ( $n = 21$ ), followed by athletics ( $n = 17$ ) and cycling ( $n = 15$ ) (Table 2). No injury was documented in badminton, boxing, lawn bowl, snooker billiards, triathlon, and rugby. Female athletes had slightly higher injury rates (26.4 per 100 athletes) compared to male athletes (25.4 per 100 athletes). Most injuries ( $n = 175$ , 86.6%) occurred during training while the rest were sustained either during competition ( $n=25$ , 12.4%) or non-sports related activities ( $n=2$ , 1%). Most sports reported injuries frequently (>60%) occurred during training sessions except for Pencak Silat. In Pencak Silat, of the total seven injuries diagnosed, 71.4% occurred in competition. The majority of the injuries ( $n = 160$ , 79.2%) reported among Malaysian athletes were classified as non-contact injuries, with more than half ( $n = 107$ , 66.9%) being overused. Only one-fifth of the total injuries resulted from contact with another person ( $n = 27$ , 13.4%) or with an object ( $n = 15$ , 7.4%). In terms of severity, the majority of the injuries ( $n = 189$ , 93.6%) were categorised as mild (<7 days off sports). Among these, majority ( $n = 153$ , 80.1%) were non-contact injuries. Twelve injuries were categorised as moderate (7-28 days off sports) injuries with nine injuries occurred during training and three injuries were sustained during competition. Only one severe injury (> 28 days off sports) was recorded throughout the Games.

**Table 2.** Overall injuries diagnosed among Malaysian athletes at the KL Sea Games 2017 by sport, severity, match and training sessions

Sport	Athletes (n)	Injuries (%)					
		All	Mild	Moderate	Severe	Training	Competition
Aquatics	79	13 (6.4)	13 (6.4)	0 (0.0)	0 (0.0)	13 (7.4)	0 (0.0)
Archery	16	3 (1.5)	3 (1.5)	0 (0.0)	0 (0.0)	3 (1.7)	0 (0.0)
Athletics	63	17 (8.4)	15 (7.4)	2 (1.0)	0 (0.0)	16 (9.1)	1 (4.0)
Basketball	24	2 (1.0)	2 (1.0)	0 (0.0)	0 (0.0)	2 (1.1)	0 (0.0)
Cricket	34	13 (6.4)	11 (5.5)	2 (1.0)	0 (0.0)	11 (1.7)	1 (4.0)
Cycling	33	15 (7.4)	15 (7.4)	0 (0.0)	0 (0.0)	13 (6.3)	1 (4.0)
Equestrian	20	1 (0.5)	1 (0.5)	0 (0.0)	0 (0.0)	1 (0.6)	0 (0.0)
Fencing	12	10 (5.0)	10 (5.0)	0 (0.0)	0 (0.0)	9 (5.1)	1 (4.0)
Football	72	5 (2.5)	4 (2.0)	1 (0.5)	0 (0.0)	5 (2.9)	0 (0.0)
Golf	7	5 (2.5)	5 (2.5)	0 (0.0)	0 (0.0)	5 (2.9)	0 (0.0)
Gymnastics	22	14 (6.9)	13 (6.4)	1 (0.5)	0 (0.0)	13 (7.4)	1 (4.0)
Hockey	60	10 (5.9)	9 (4.5)	1 (0.5)	0 (0.0)	6 (3.4)	4 (16.0)
Ice Hockey	20	6 (1.0)	5 (2.5)	1 (0.5)	0 (0.0)	4 (2.3)	2 (8.0)
Ice Skating	14	4 (2.0)	4 (2.0)	0 (0.0)	0 (0.0)	4 (2.3)	0 (0.0)
Judo	6	8 (4.0)	7 (3.5)	1 (0.5)	0 (0.0)	6 (3.4)	2 (8.0)
Karate	19	2 (1.0)	2 (1.0)	0 (0.0)	0 (0.0)	2 (1.1)	0 (0.0)
Muay thai	5	1 (0.5)	1 (0.5)	0 (0.0)	0 (0.0)	1 (0.6)	0 (0.0)
Netball	12	7 (3.5)	7 (3.5)	0 (0.0)	0 (0.0)	6 (3.4)	1 (4.0)
Petanque	16	1 (0.5)	1 (0.5)	0 (0.0)	0 (0.0)	1 (0.6)	0 (0.0)
Sailing	22	1 (0.5)	1 (0.5)	0 (0.0)	0 (0.0)	1 (0.6)	0 (0.0)
Sepak takraw	45	5 (2.5)	5 (2.5)	0 (0.0)	0 (0.0)	5 (2.9)	0 (0.0)
Shooting	20	1 (0.5)	1 (0.5)	0 (0.0)	0 (0.0)	1 (0.6)	0 (0.0)
Silat	26	7 (3.5)	6 (3.0)	0 (0.0)	1 (0.5)	2 (1.1)	5 (20.0)
Squash	16	3 (1.5)	3 (1.5)	0 (0.0)	0 (0.0)	3 (1.7)	0 (0.0)
Table tennis	10	3 (1.5)	3 (1.5)	0 (0.0)	0 (0.0)	2 (1.1)	1 (4.0)
Taekwondo	18	5 (2.5)	5 (2.5)	0 (0.0)	0 (0.0)	3 (1.7)	2 (8.0)
Tennis	10	6 (3.0)	5 (2.5)	1 (0.5)	0 (0.0)	6 (3.4)	0 (0.0)
Tenpin Bowling	12	5 (2.5)	4 (2.0)	1 (0.5)	0 (0.0)	3 (1.7)	2 (8.0)
Volleyball	24	21 (10.4)	20 (9.9)	1 (0.5)	0 (0.0)	21 (12.0)	0 (0.0)
Water-skiing	8	4 (2.0)	4 (2.0)	0 (0.0)	0 (0.0)	3 (1.7)	1 (4.0)
Weightlifting	5	3 (1.5)	3 (1.5)	0 (0.0)	0 (0.0)	3 (1.7)	0 (0.0)
Wushu	12	1 (0.5)	1 (0.)	0 (0.0)	0 (0.0)	1 (0.6)	0 (0.0)
Total	762*	202	189	12	1	175#	25#

\* No injuries were documented in 6 sports (badminton, boxing, lawn bowl, snooker billiards, triathlon, rugby) (83 athletes)

# Two injuries did not occur during either match or training sessions



Injuries involving the lower limb had the highest prevalence ( $n = 116$ , 57.4%), followed by the upper limb ( $n = 55$ , 27.2%) and the trunk ( $n = 31$ , 15.3%). The most common injuries diagnosed among athletes were muscle tear/strains ( $n = 65$ , 32.2%), ligamentous injuries ( $n = 21.3\%$ ), tendon injuries ( $n = 33$ , 16.3%) and bruises/contusions ( $n = 32$ , 15.8%). Only five injuries with potential severe complications were diagnosed including, laceration wound ( $n = 3$ ), dental ( $n = 1$ ) and concussion ( $n = 1$ ).

Logistic regression was performed to explore the predictors of injury severity among athletes. Age, type of injury (new or recurrent), mechanism of injury (contact or non-contact), and occasion associated with injury (training or competition) met the criteria for inclusion in the multivariate analysis. Athletes with recurrent injury were four times more likely to sustain a severe injury, compared to those with a new injury. Additionally, for every one-year increase in athletes' age, there is a 5% increase in the likelihood of sustaining a moderate or severe injury.

#### ***Illness rate and distribution of illness among athletes***

Among the athletes, a total of 238 illnesses was diagnosed, representing an overall illness rate of 28.2 per 100 athletes (Table 1). A slightly higher proportion of female athletes ( $n = 121$ , 50.8%) were diagnosed with illness at the games. The most frequent illness diagnosed were conditions related to the respiratory system ( $n = 156$ , 65.5%), followed by the gastrointestinal system ( $n = 36$ , 15.1%), and the integumentary system ( $n = 11$ , 4.6%). Aquatic athletes reported the highest number of illness ( $n = 25$ , 10.5%) at the games, followed by cricket ( $n = 16$ , 6.7%), athletics ( $n = 15$ , 6.3%), hockey ( $n = 15$ , 6.3%), and sepak takraw ( $n = 12$ , 5%). There was no illness documented among athletes who participated in triathlon and snooker billiards.

#### ***Injury rate, illness rate, and the distribution among officials***

There were 11 injuries diagnosed among the officials, representing an overall injury rate of 2.8 per 100 officials. The majority of the injuries were mild (90.9%) and were non-contact related. Of these injuries, 90.9% were overuse and 9.1% were overstretched injuries. The types of injuries were muscle tear/strains ( $n = 5$ ), bruises/contusions ( $n = 5$ ), while one injury was an abrasion wound.

Among the 390 officials, a total of 58 illnesses was diagnosed representing an overall illness rate of 14.9 illness per 100 officials. The types of illnesses diagnosed affected multiple systems, but the most frequent illness diagnosed were the respiratory system ( $n = 33$ , 56.9%), the gastrointestinal system ( $n = 8$ , 13.8%), and the nervous system ( $n = 5$ , 8.6%).

#### **Discussion and Conclusion**

The injury and illness rates among Malaysian athletes in this study were lower compared to previous research; 43.8% and 30.1%<sup>3</sup> and 30.0% and 23.0%<sup>4</sup>. Compared to the Asian Games 2014 more injuries ( $n = 202$  vs  $n = 83$ ) and illnesses ( $n = 238$  vs  $n = 64$ ) were diagnosed during the KL SEA Games 2017. This could be due to the larger contingent size ( $n=1235$ ) in this study, hence any change in the number of injuries or illnesses may directly influence the prevalence rate to a smaller degree.

The limited number of medical staff in the previous reports could also contribute to the possibility of under-representation of injuries during training sessions<sup>4</sup>. Whereas for this study, there was more medical staffs ( $n=43$ ) in the contingent, thus higher surveillance of injuries in all sports competed, during both competition and training sessions.

When injuries among athletes were classified based on types of sports, volleyball had the highest number of injuries, followed by athletics and cycling. This is contrasted to a previous report whereby the highest number of injuries were found in badminton, hockey, and rugby. These findings could be attributed to more numbers of athletes and types of sports participated by the Malaysian athletes during the KL Sea Games compared to the Asian Games ( $n=38$  vs  $n = 24$ )<sup>4</sup>. Moreover, in the previous study, no athletes participated in volleyball, also Malaysia was represented by only seven athletes in cycling and six athletes in athletics<sup>4</sup>.

Comparable to the previous report, the majority of injuries among athletes occurred during training<sup>4</sup>. The current study however found a higher injury prevalence rate (86.1%) during training compared to the Asian Games 2014<sup>4</sup>. However, this is in contrast with other international multi-sports event studies whereby the prevalence rates range from 25 – 57%<sup>2,4,12,13</sup>.

In all sports, the majority of the injuries occurred during training except for Pencak Silat. This

may be due to the fact that Pencak Silat is a full-contact sport and a previous study reported a high incidence rate (24.4 per 100 athletes) during the competition<sup>14</sup>.

This study also showed that injuries sustained during training tend to be more severe injuries. This is concerning because apart from the higher prevalence of injuries at training, injuries that occurred during this session were more likely to be severe. Hence, a more in-depth assessment is required to investigate factors associated with injury during training sessions. This is to ensure appropriate and adequate preventive measures during training sessions can be implemented.

Similar to previous reports, the majority of injuries during the SEA Games were musculoskeletal injuries<sup>2,3,4,12,13</sup>. It is comforting to know that only a few numbers of moderate and severe injuries (lacerations wounds, dental and concussion injuries) were reported throughout the games. Despite this, it is important that the medical team is fully prepared in managing these less frequent but potentially life-threatening situations.

Recurrent injuries and an increase in athlete's age were significant predictors of more severe injury. This is contrary to a previous report during the Asian Games 2014, whereby the sports category was a predictor of injury severity<sup>4</sup>. It should be emphasized that, during the KL Sea Games 2017, some sports have both individual and team events such as aquatic (water polo, diving, swimming) hence, cannot be categorised according to a single sport type.

Studies have shown that participation in competitions increases the risk of illness<sup>1</sup>. Furthermore, acute illness can significantly affect athletes' performance and may lead to loss of training time and competition<sup>1</sup>. Respiratory illness was the most common illness reported in this study, followed by gastroenterology and dermatology. These findings are comparable to the previous report<sup>4</sup>.

Similar to previous research, the respiratory system was the most common illness reported in this study<sup>4,8,15</sup>. High prevalence of upper respiratory tract infections and airway hyperresponsiveness including asthma, were diagnosed during high-level competitions<sup>15,16</sup>. Factors including high respiratory airflow rates during high-intensity exercise, over training-induced "immunosuppression", crowding at competition venues (athletes village and competitions venues),

and regular changes in temperature due to regular movement of athletes from accommodation to venues are factors that could contribute to respiratory infections<sup>4,12, 17</sup>.

The participation of national contingents at international multi-sports events comprises of not only athletes but also officials. These officials are crucial in ensuring that the athletes to perform at their best at these events. While there are many studies that explore the patterns of injury and illness among athletes at international sports competitions, this is the first study to explore the pattern of injury and illness including the officials and support staffs<sup>2,3,4,12,13</sup>.

Approximately 15% of the Malaysian contingents' medical consultations were with the contingent's official. This information is extremely useful for the preparation of resources of the contingent medical team. The pattern and rate of injury and illness were expected to be different between athletes and officials due to the different socio-demographic, underlying medical illness and physical activities.

The injury rate among the officials was much lower compared to athletes (2.8 vs 23.9 per 100 athletes). This might be due to lower exposure of officials to physical activities associated with injuries (training and competitions). The majority (n =10, 90.9%) of the injuries sustained by officials were overuse injuries that occur during a training session conducted for the athletes.

Despite the higher prevalence of chronic diseases among the officials', the illness rate throughout the games was half of the athletes' illness rate (14.9 vs 28.2 illnesses per 100 person).

Respiratory illness was the most frequent medical illness diagnosed among the officials. The risk of contracting an infectious disease was shown to increase in sports events due to enhance transmission among athletes<sup>18</sup>. Hence, precaution should also be made among officials, to prevent spread to other contingent members including to the athletes who will be performing.

The Malaysian contingent was represented by 845 athletes and 390 officials at the KL SEA Games 2017. The rate of injuries and illness among athletes was 23.9 and 28.2 per 100 athletes, respectively. The rate and illness among the officials were 2.8 and 14.9 per 100 athletes, respectively. The majority of injuries among athletes were mild and occurred during training. Most illnesses

among athletes and officials were mild and did not require referral to secondary or tertiary health facilities. Further study is needed to explore the causes of injuries and illness to develop preventive measures and plan of medical resources for future competitions.

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None.

#### **Conflict of interest**

No conflict of interest exists.

#### **Ethical clearance**

This study was approved by the National Sports Institute of Malaysia Research Committee (ISNRP-005-02017).

#### **Authors' contribution**

Data gathering and idea owner of this study: AM;  
Study design: AM, MS; Data gathering: AM, KH, AP; Writing and submitting manuscript: AM, MS; Editing and approval of final draft: AM, MS, KH, AP.

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