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# Injury data of major international field hockey tournaments

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## ABSTRACT

**Background** Detailed injury data are not available for international tournaments in field hockey. We investigated the epidemiology of field hockey injuries during major International Hockey Federation (Fédération Internationale de Hockey, FIH) tournaments in 2013.

**Materials and methods** FIH injury reports were used for data collection. All major FIH tournaments for women (n=5) and men (n=11) in 2013 were included. The main focus of this study was to assess the pattern, time, site on the pitch, body site and mechanism of each of the injuries. We calculated the average number of injuries per match and the number of injuries per 1000 player match hours.

**Results** The average number of injuries was 0.7 (95% CI 0.5 to 1.0) per match in women's tournaments and 1.2 (95% CI 0.8 to 1.7) per match in men's tournaments. The number of injuries per 1000 player match hours ranged from 23.4 to 44.2 (average 29.1; 95% CI 18.6 to 39.7) in women and 20.8 to 90.9 (average 48.3; 95% CI 30.9 to 65.8) in men. Most injuries occurred in the circle (n=25, 50%, in women, n=95, 51%, in men). The rate of injuries increased after the first quarter. Injuries to the head and face (n=20, 40%) were most common in women. The head/face (n=51, 27%) and the thigh/knee (n=52, 28%) were equally affected in men. The ball caused the most injuries, followed by the stick, collisions and tripping/falling. There were no deaths or injuries that required hospital treatment in the entire cohort.

**Summary** Field hockey has a low incidence of acute injuries during competition.

hockey in Australia and Junior World Cup hockey.<sup>1–6</sup> Sport injury epidemiology data were obtained at the 2004, 2008 and 2012 Olympic Games, and these data contain basic information on hockey injuries.<sup>7–9</sup> However, these injuries (or illnesses) were recorded using different systems. Injuries during competition (matches) were collected for selected team sports during the 2004 Olympics, whereas in 2008 and 2012 the head physicians of the National Olympic Committees reported the daily occurrence (or non-occurrence) of newly sustained injuries and illnesses during competition and training. Furthermore, owing to the IOC's commitment to protection of the health of the athletes, information was retrieved on all athletes treated in the polyclinic and medical venues during the Olympics.<sup>10</sup>

Injury data collection is a mainstay of injury prevention in professional sports.<sup>11–12</sup> For example, the World Football Association (Fédération Internationale de Football Association, FIFA) has a comprehensive injury recording system.<sup>13–15</sup> The International Hockey Federation (Fédération Internationale de Hockey, FIH) requires a basic collection of all injuries by officials at every international tournament using a standardised match report form.

The present study evaluated all data on injuries during major international FIH events that were collected on match report forms and investigated the incidence and severity of injuries during international field hockey tournaments.

## INTRODUCTION

Field hockey's beginnings can be linked to rudimentary games with a stick and a ball as far back as 300 BC in East Asia and Greece. Today's hockey found its origin in England/Scotland and the Netherlands. The game is now played in 132 countries around the world attracting many active players; there are 37 000 players in Belgium, more than 80 000 in Germany and more than 250 000 in the Netherlands (<http://www.fih.ch>). The International Hockey Federation (Fédération Internationale de Hockey, FIH) is the governing body for the five continental federations of hockey.

Hockey, played on artificial turf, natural grass and indoors, is one of the fastest team sports. Recent changes to field hockey rules (such as the self-pass and the permission of playing high balls) have made the game even faster and possibly more dangerous (ie, more prone to specific injuries).

Few data exist on injuries in field hockey played at a high international level. There are injury reports on college field hockey in the USA, national

## MATERIALS AND METHODS

FIH match officials at major international hockey tournaments registered injury data as they occurred at matches in 2013. An injury was defined as a new musculoskeletal symptom or concussion that led to time stoppage when the player was unable to continue playing during the competition. Therefore, all injuries were rated as acute injuries. The officials (Technical Officer, Judge) noted all of the injuries that caused time stoppage by the umpires, leading to treatment either on the field or off-site. These injuries were notified within a specific match injury report, which was generally provided to the FIH Medical Officer and subsequently to the FIH Medical Panel.

Two independent reviewers (author and senior author) evaluated official match report forms and identified information on injury pattern, time, site on the pitch, body site and mechanism. The match injury reports were blinded for the player numbers. The average number of injuries per match and the number of injuries per 1000 player match hours including the 95% CI were calculated for the



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respective tournaments. All injuries were standardised to 1000 player match hours for better comparison to other (team sport) injuries. Total player match hours were calculated as follows: number of games times 70 min per game times 22 players per game divided by 60 min. Data were processed using Excel and SPSS software. The ethics committee of the Goethe-University of Frankfurt approved the study.

## RESULTS

Data were collected from 16 FIH international tournaments in 2013. There were five women's tournaments (4 Nations Tournament, New Zealand 2013; East Asia Games, Tianjin, China 2013; World League Final, Tucuman 2013; World League Round 2, New Delhi, India 2013; and World League Round 2, Rio de Janeiro, Brazil 2013) and 11 men's tournaments (Africa Cup of Nations, Nairobi, Kenya 2013; East Asian Games, Tianjin, China 2013; Junior World Cup, New Delhi, India 2013; Oceania Cup, Stratford, New Zealand 2013; Sultan of Johor Cup, Johor, Malaysia 2013; World League Round 2, New Delhi, India 2013; World League Round 2, Elektrostal, Russia 2013; World League Round 2, Rio de Janeiro, Brazil 2013; World League Round 2, Paris, France; World League Semi-final, Johor, Malaysia 2013; and World League Semi-final, Rotterdam, the Netherlands 2013).

The total number of matches was 66 for women and 188 for men. All match report forms on injuries were available. The average number of injuries was 0.7 (95% CI 0.5 to 1.0) per match in women and 1.2 (95% CI 0.8 to 1.7) per match in men (tables 1 and 2).

The number of injuries per 1000 player match hours ranged from 23.4 to 44.2 (average 29.1 with 95% CI 18.6 to 39.7) in women and 20.8 to 90.9 (average 48.3 with 95% CI 30.9 to 65.8) in men (tables 1 and 2). In men and women, the rate of injuries varied per quarter of the match. Fewer injuries occurred during the first-quarter of the game compared with the remaining quarters (table 3).

Half of all injuries occurred within the circle (25 injuries (50%) in women; 95 injuries (51%) in men), followed by the 25-yard zone (17 injuries (34%) in women; 59 injuries (32%) in men) and the midfield (6 injuries (12%) in women; 32 injuries (17%) in men; table 3).

The most frequently observed mechanism of injury was the result of a hit by the ball in both sexes (26 injuries (52%) in women and 69 injuries (37%) in men; table 3).

Injury pattern according to type of injury was different in women compared to men. The vast majority of injuries in women's tournaments occurred to the head and face (20 injuries, 40%), whereas all other body parts were almost equally less

affected (table 3). Collectively, there were no abdominal or trunk injuries reported for women. In men, head and face (51 injuries, 27%) and thigh and knee (52 injuries, 28%) were the most common sites of injury. Seven abdominal injuries (4%) were registered in men (table 3).

## DISCUSSION

This study is the first to collect data on injuries in major FIH international hockey tournaments. It investigated average injury numbers per match in women and men and the number of injuries per 1000 player match hours in both sexes. Injuries were registered during competition when time stoppage occurred. Time stoppage occurred when a player was not able to continue playing due to a new musculoskeletal symptom or concussion.

At the match site, data were recorded by non-medical match officials supervised by medical staff. Comparisons to other injury data are limited because the methods of injury recording are different.<sup>11</sup> Injuries that resulted in the absence of training and/or competition were not specifically noticed in our cohort.<sup>16</sup>

The FIH uses injury forms that are completed by match officials during matches for every injury that requires time stoppage by the umpires. This system of data collection may result in an underestimate of injuries compared with the registration of every injury that required medical attention despite time stoppage. A strength of our data collection was the complete return rate of forms because it is policy for all official hockey tournaments.

### Sex comparison

The comparison between women and men demonstrated that women sustained fewer injuries than men. This difference was shown by the lower overall injury rates per match and lower injury rates per 1000 player match hours (29.1 injuries in women vs 48.3 injuries in men). Both sexes suffered the most injuries to the face and head, followed by injuries to the calf and ankle in women and the thigh and knee in men.

### Body part affected

Another study reported the number of head and face injuries at the 2009 Men's Junior World Cup as 16 injuries per 1000 player match hours.<sup>5</sup> We found rates of 12 and 11 injuries per 1000 player match hours to the head and face in women and men, respectively (data not shown in table). It is notable that all of the recorded injuries to the head or face in this study were minor. Nevertheless, this high proportion of face and head injuries needs to be addressed because they may reflect the

**Table 1** Total and average number of injuries and injuries per 1000 match hours of official FIH tournaments in 2013 (Women)

Official tournaments in 2013	Number of matches	Total match hours*	Number of injuries	Average number of injuries per match	Injuries per 1000 player match hours
4 Nations Tournament (Stratford, New Zealand)	6	154	4	0.7	26.0
East Asia Games (Tianjin, China)	6	154	4	0.7	26.0
World League Final (San Miguel de Tucumán, Argentina)	24	616	16	0.7	26.0
World League Round 2 (New Delhi, India)	15	385	17	1.1	44.2
World League Round 2 (Rio de Janeiro, Brazil)	15	385	9	0.6	23.4
Overall average (95% CI)	66	1694	50	0.7 (0.5 to 1.0)	29.1 (18.6 to 39.7)

\*Total match hours=number of games×70 min per game×22 players per game/60 min.  
CI=1.96×SD/square root of number of injuries.  
FIH, Fédération Internationale de Hockey.

**Table 2** Total and average number of injuries and injuries per 1000 match hours of 11 official FIH tournaments in 2013 (Men)

Official tournaments in 2013	Number of matches	Total match hours*	Number of injuries	Average number of injuries per match	Injuries per 1000 player match hours
Africa Cup of Nations (Nairobi, Kenya)	6	154	14	2.3	90.9
East Asia Games (Tianjin, China)	6	154	14	2.3	90.9
Junior World Cup (New Delhi, India)	44	1129	31	0.7	27.4
Oceania Cup (Stratford, New Zealand)	6	154	12	2.0	77.9
Sultan of Johor Cup (Johor, Malaysia)	18	462	13	0.7	28.1
World League Round 2 (New Delhi, India)	15	385	17	1.1	44.2
World League Round 2 (Elektrostal, Russia)	15	385	17	1.1	44.2
World League Round 2 (Paris, France)	15	385	10	0.6	26.0
World League Round 2 (Rio de Janeiro, Brazil)	15	385	8	0.5	20.8
World League Semi-final (Johor, Malaysia)	24	616	26	1.0	42.2
World League Semi-final (Rotterdam, Netherlands)	24	616	24	1.0	39.0
Overall average (95% CI)	188	4825	186	1.2 (0.8 to 1.7)	48.3 (30.9 to 65.8)

\*Total match hours=number of games×70 min per game×22 players per game/60 min.  
 CI=1.96×SD/square root of number of injuries.  
 FIH, Fédération Internationale de Hockey.

intermediate result of the liberalisation to play high balls all over the pitch, especially within the circle.

Another previously published study showed an incidence of upper limb injuries of 0.48 per match and 19 per 1000 player match hours at the 2009 Men's Field Hockey Junior World Cup.<sup>4</sup> Our data showed 0.2 upper limb injuries per match and 7.5 injuries per 1000 player match hours in men's tournaments (data not displayed in table 3). This discrepancy may arise because a three-phase prospective data sampling was performed in the study of Mukherjee,<sup>4</sup> which also included time after the match until the following day. Our data assessment focused on injuries that occurred only during the actual match.

### Injury trends over time

Comparison with previous reports was difficult because most published data have been collected in specific settings, such as during the Olympics in 2004, 2008 and 2012 as well as in college hockey or junior games.<sup>1-9</sup> Our findings were consistent with those of the 2004 Olympics<sup>7</sup> (1.2 in men and 0.7 in women now, 1.2 in men and 0.4 in women in the 2004 Olympics). Comparing our data on injuries per 1000 player hours to the 2012 Olympics, we show a higher injury incidence in women (29.1 vs 14). There was no difference between men

at those two time points (47 vs 48.3).<sup>9</sup> The rate of injuries was measured differently during the following Olympic games in 2008 and 2012.<sup>8,9</sup>

### Did injuries occur in games or at training?

The major finding related to sports setting and injury. Approximately 2/3 of injuries occur during competition in hockey compared to training. It is not surprising that most of the injuries occurred within the circle in both genders. The assumed relationship of these injuries with penalty corners could not be shown because of the limited data sample. Contact with the ball and stick are the primary causes of most injuries.

### Mechanisms of injury

Injuries caused by the stick and ball are common in field hockey. A most recent study from E Gardner on head injuries in American collegiate women's field hockey showed that 47.9% of all head injuries were caused by an elevated ball and 21.7% by the stick.<sup>6</sup> In our data set, we did not correlate injury mechanisms to a specific injury site. However, these data match well with our observation of injury mechanisms in general.

One interesting result of our study was that only a moderate number of injuries resulted from non-contact causes, such as

**Table 3** Injury analysis

Number of injuries by the following						
Match minute	1-17	18-35	36-53	54-70	Unknown	
Women	7 (14%)	14 (28%)	12 (24%)	15 (30%)	2 (4%)	
Men	27 (15%)	51 (27%)	50 (27%)	58 (31%)	0	
Field site	Circle	25-yard line	Midfield	Unknown		
Women	25 (50%)	17 (34%)	6 (12%)	2 (4%)		
Men	95 (51%)	59 (32%)	32 (17%)	0		
Mechanism	Ball	Stick	Player collision	Tripping/falling	Unknown	
Women	26 (52%)	7 (14%)	6 (12%)	10 (20%)	1 (2%)	
Men	69 (37%)	47(25%)	42 (23%)	28 (15%)	0	
Body site	Head/face	Finger/hand	Trunk/abdomen	Thigh/knee	Calf/ankle	Unknown
Women	20 (40%)	7 (14%)	0	6 (12%)	8 (16%)	9 (18%)
Men	51 (27%)	36 (19%)	7 (4%)	52 (28%)	24 (13%)	16 (9%)

Total number of injuries: 50 (women), 186 (men).

tripping. This result is different from previously reported data, where clearly higher rates of non-contact injuries were reported in women college field hockey.<sup>3</sup> However, this study also included injuries during practice.

### The rate of hockey injuries compared with other sports

Data exist on injuries in other team sports, such as soccer, rugby, hurling, Gaelic football and handball.<sup>17–22</sup> Comparisons with other team sports revealed an overall lower number of average injuries per 1000 player match hours in hockey, that is, 29.1 in women's hockey compared to 35.5 in women's rugby and 48.3 in men's hockey compared to 61.75 in Hurling, 61.8 in Gaelic Football, 89.1 in Rugby, 108 in Handball and 111–158 in Futsal.<sup>17–22</sup> Only Soccer had a lower rate of injuries at 40.1 per 1000 player hours.<sup>11</sup> This overall low injury rate was unexpected because hockey players are generally assumed to suffer more injuries because of the use of a stick, a solid ball (which can travel more than 100 km/h) and the fast nature of the game on a small pitch.

### SUMMARY

This report is the first study of injury incidence and type in FIH international tournaments. Field hockey has a low incidence of acute injuries during competition. We recommend that the Federation continues to monitor best practice in sports injury epidemiology, commit to rigorous data collection and consider recording injuries and illness out of competition.<sup>23</sup> This would provide a foundation for further efforts to prevent injuries and protect the health of hockey players.

#### What are the new findings?

- ▶ Severe injuries are rare in international field hockey
- ▶ Most injuries affect the head of the players.
- ▶ Most of the injuries occur within the circle.

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

- ▶ Our data provide a basis for prospective data sampling.
- ▶ The injury sampling system of Fédération Internationale de Hockey (FIH) needs to be improved to reach the standards of other sports.
- ▶ Injuries to the head and face are a matter of concern and should be closely followed up to justify possible rule changes.
- ▶ Our data are not yet suitable for recommendations for injury prevention in field hockey.

**Contributors** T-MT was responsible for data analysis and drafting of the manuscript. PWB was responsible for data acquisition and critically revised the content. WM-E was responsible for data acquisition and revisions of the manuscript.

UR designed the study, data interpretation and the final approval of the submitted version.

**Competing interests** None declared.

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