1 TITLE PAGE

2 The epidemiology of injuries in football at the London 2012 Paralympic Games

ABSTRACT

Background: The epidemiology of injury in Paralympic football has received little attention. A study of all sports at the London 2012 Paralympic Games identified football 5-a-side as the sport with the highest injury rate, meriting further detailed analysis, which may allow for future preventative strategies.

Objective: To examine the injury rates and risk factors associated with injury in Paralympic football.

Design: Secondary analysis of a prospective cohort study of injuries to football 5-a-side and football 7-a-side athletes.

Setting: London 2012 Paralympic Games

Participants: 70 football 5-a-side athletes and 96 football 7-a-side athletes. Athletes from all but one country chose to participate in this study.

Methods: The Paralympic Injury and Illness Surveillance System was used to track injuries over the Games, with data entered by medical staff

Main Outcome Measurements: Injury incidence rate (IR) and injury incidence proportion (IP).

Results: The overall IR for football 5-a-side was 22.4 injuries /1000 athlete-days (95% CI; 14.1-33.8) with an IP of 31.4 injuries per 100 athletes (95% CI; 20.9-43.6). In 5-a-side competition, 62.5% of injuries were associated with foul play. The overall IR for football 7-a-side was 10.4 injuries/1000 athlete-days (95% CI; 5.4-15.5), with an IP of 14.6 injuries per 100 athletes (95% CI; 7.5-21.6). The most commonly injured body region in both sports was the lower extremity.

Conclusions: To our knowledge, this is the first study examining IR and risk factors associated with injury in Paralympic football. Future studies are needed to determine mechanisms of injury and independent risk factors for injury, thus informing prevention strategies.

INTRODUCTION

Football (more familiarly known in the United States as soccer) is arguably the world's most popular sport, and injury rates in football have been studied extensively in elite able-bodied athletes[1-5]. In recent studies, injury rates in male able-bodied football players have been reported at 27.0 injuries per 1000 player-days[5], with an injury incidence proportion at the summer Olympic Games of 27 injuries/100 players[1]. Approximately 70% of injuries affect the lower limb[4], and 56% of injuries are not associated with time-loss[4]. A study examining football injuries at the 2012 London Olympic Games reported that 74.2% of football injuries occurred in competition and that the injury incidence rate (IR) for football was one of the highest of all Olympic summer sports[1].

The International Paralympic Committee (IPC) has completed injury surveillance at the last three Winter Games - a major advance in Paralympic injury epidemiology[6,7]. The London 2012 Paralympic Games were the first summer Games where injury and illness surveillance was systematically conducted[8,9]. Injuries in Paralympic football have not previously been prospectively studied.

There are two versions of football played in the Paralympic Games – football 5-a-side and football 7-a-side. Football 5-a-side is a sport played by athletes with visual impairment. It has become an increasingly popular sport, having started out as a game for children in schools for the visually impaired (VI). It evolved in different countries before coming under the governance of the International Blind Sports Federation (IBSA) in 1996.

Subsequently, an internationally recognized set of rules was developed for the sport[10]. Under these regulations, football 5-a-side made its debut at the 2004 Athens Paralympic Games, thereafter growing to its largest number of participants at the 2012 London Paralympic Games. The rules are adapted from the International Federation of Associated Football (FIFA) and include four outfield players and a sighted goalkeeper on each team. The game has two periods of twenty-five minutes and is played on a pitch sized 40 meters by 20 meters for international matches. The pitch is surrounded by boarding (kickboards), 1-1.2m in height, to form a perimeter and to assist players in determining their location on the pitch. The ball contains a sound system for making a noise when in motion so that players can detect the ball's location. Although athletes with different levels of visual impairment can participate, all players must use an IBSA-approved eye-shade to ensure an equal level of visual impairment during competition. Full details of the rules may be obtained from the IBSA website[10].

Football 7-a-side has been a Paralympic sport since 1984 and is played exclusively by athletes with central neurologic injury, including cerebral palsy and traumatic brain injury. Athletes must have ataxia, hypertonia, or athetosis. Players are divided into four classes based on their level of physical impairment[11]. The sport is similar to able-bodied football, with the exceptions of: seven players on the field at a time per team, the measurements of the playing field are smaller, there is no offside rule, throw-ins may be made with just one hand, and matches consist of two halves of 30 minutes each[12].

Injury surveillance is essential to evaluating risk factors for participation in sport with a view to inform the development and evaluation of prevention strategies and protect the long-term health of athletes[13]. Injuries in professional football have been well-documented for many years[14], with well-developed research methodologies in place[15-18]. The lessons learned from these studies are being put into practice in efforts to improve the health of players.

Willick et al. reported injury incidence rate (IR) values for all sports in the London 2012 Paralympic Games[9]. The overall IR was 12.7 injuries/1000 athlete-days across all sports (95% CI 11.7 to 13.7). Football 5-a-side was identified as the sport with the highest IR of 22.4 injuries/1000 athlete-days. This study also reported an injury incidence rate for football 7-a-side of 11.2 injuries per 1000 athlete-days, similar to the overall rate reported for Paralympic athletes in all sports. More in-depth analysis of this same dataset was performed to better characterize injuries in the hopes of guiding future preventative strategies specific to these sports. Though the incidence rates carry important information, the timing and anatomic location of the injuries, in addition to the demographic information of the injured athletes, should improve injury characterization for guiding these strategies.

The objective of this study was to determine the injury incidence rate, characteristics of injury and risk factors for injury in athletes playing football 5-a-side and football 7-a-side at the London 2012 Paralympic Games.

METHODS

This sport-specific cohort study was a component of the larger injury and illness surveillance study completed by the IPC at the London 2012 Paralympic Games. One of the eight football 5-a-side teams in the tournament opted not to participate in the study. All eight football 7-a-side teams participated in the study. The participants included 70 athletes from 7 countries participating in the football 5-a-side competition and 96 athletes from 8 countries participating in the football 7-a-side competition. Data were collected over a 14-day period, including 3 days prior to the start of competition and 11 days of the competition period. The seven participating teams in football 5-a-side teams each played three group matches (total 21 match exposures) followed by 14 medal and ranking match exposures, thus totaling 35 match exposures. The eight football 7-a-side teams each played three group matches (total 24 match exposures) followed by 16 medal and ranking match exposures, totaling 40 match exposures. A match exposure is defined as one team playing one game; therefore, one match involves two match exposures.

Procedures

The Paralympic Injury and Illness Surveillance System was approved by the IPC. Prior to initiation of the study, ethics board approval was obtained through the University of Brighton in the United Kingdom (FREGS/ES/12/11) and the University of Cape Town Health Sciences Research Ethics Committee in South Africa (HREC/REF 436/2012).

Athletes consent to the use of their de-identified medical data for research purposes was obtained at the time of their registration for the Games.

A comprehensive database of basic athlete demographic information was obtained from the IPC, containing the following de-identified information: age, country code, and accreditation number.

Data regarding injuries was gathered via two sources. First, a database was populated from the electronic medical data capture system (EMDCS) (ATOS, France) utilized at all athlete medical stations operated by the London Organizing Committee for the Olympic and Paralympic Games (LOCOG). LOCOG medical staff entered all injury encounters when an athlete presented to a medical station with a complaint consistent with the pre-determined definition of injury. A second database was populated by medical staff providing care for their own teams utilizing a novel web-based injury and illness surveillance system (WEB-IISS) that has been developed specifically for the purposes of this study[19]. Utilization of the WEB-IISS allowed for the gathering of greater clinical detail regarding injury. The final database contained no information that could personally identify any individual athlete.

Injury Definitions

For the purposes of this study, an injury was defined as ‘any newly acquired injury as well as exacerbations of preexisting injury that occurred during training and/or competition of

the 14 day pre-competition and competition period of the London 2012 Paralympic Games.' An acute traumatic injury was considered 'an injury that was caused by an acute precipitating traumatic event.' An acute on chronic injury was considered 'an acute injury in an athlete with symptoms of a chronic injury in the same anatomical area.' Finally, a chronic (overuse) injury was considered 'an injury that developed over days, weeks or months and was not associated with any acute precipitating event.'

Statistical Analysis

Descriptive statistics including means (95% CI), medians (range) and proportions (95% CI) were used to describe athlete characteristics. IR (95% CI) estimates were based on Poisson regression analysis controlling for important covariates, clustering by country and offset for exposure days. Injury IRs and 95% CI were estimated based on frequency of injuries reported (e.g. overall, by age group, and by anatomical region) and total number of athletes-days of participation based on the total number of athlete-days reported for each delegation. The injury incidence proportion (IP) (95% CI) was reported as the number of injuries per 100 athletes. The 95% CI was used to determine significant differences in the incidence data.

RESULTS

Football 5-a-side

Injury incidence proportion and incidence rate

The seven teams participating each consisted of a squad of 10 players comprising 8 VI outfield players and 2 sighted goalkeepers (n= 70 players). Thus, with data collection over a 14-day period the total exposure for training and competition was 980 athlete-days. Table 1 outlines the incidence rates for the 70 football 5-a-side athletes who participated in our study. Duration of time lost from the injury was not reliably recorded and was thus not included in the analysis.

During the 14 day period of the Games, 22 injuries were documented giving an IP of 31.4 injuries per 100 athletes (95% CI; 20.9-43.6) and an IR of 22.4 injuries per 1000 athlete days (95% CI; 14.1-33.8). Analysis revealed that 21 injuries were recorded by NPC medical staff via the WEB-IISS, with only one injury recorded by LOCOG medical staff via the EMDCS.

A review of the injury data by position showed that none of the goalkeepers (sighted players) experienced an injury; all injuries were incurred by the VI outfield players. Thus, calculating for 56 VI players training and competing for 14 days resulted in a total 784 athlete-days exposure. As such the IP among the VI athletes was 39.3 injuries per 100 athletes (95% CI; 26.5-53.2) and the IR was 28.1 (95% CI; 17.7-42.2) injuries per 1000 athlete-days. All further analyses relate to VI outfield players only. The number of injuries reported by participating countries ranged from 0-9 injuries per team over the duration of the games.

Acute vs. overuse injuries

When the categories of acute onset injuries and acute on chronic injuries are combined, it becomes clear that acute injuries occur more frequently than chronic overuse injuries football 5-a-side. Only 5 overuse injuries were reported in this VI cohort for an IR of 6.4 per 1000 athlete days (95% CI; 2.1-14.8). Of the 17 acute and acute on chronic injuries, 8 occurred during competition, 6 during training, 2 prior to village entry and 1 injury was non-sport related. For all acute injuries the IR was 21.7 per 1000 athlete-days (95% CI; 12.7-34.5). For acute sport-related injuries (excluding the pre-village and non-sport injury) the IR was 17.9 injuries per 1000 athlete-days (95% CI; 9.8-29.8).

There were 8 acute injuries in competition [IR = 10.2 (95% CI; 4.4-20.0)] acute injuries per 1000 athlete-days. There were 33 matches involving 8 outfield VI players per match, which totals 264 player-games. Although substitutions were made during matches, there were only 4 players that were on the field of play at any one time. The risk of any player getting an acute injury in a match was thus 1 in 33 or 3.03% (95% CI; 1.32-5.88).

All 8 injuries in competition were classified as extrinsic in mechanism. This included 7 injuries where there was contact with other athletes and 1 where there was contact with the ball leading to injury. Among these acute competition injuries with extrinsic mechanisms, 5 out of 8 (62.5%) were reported as relating to foul play and contact with another athlete.

Anatomical location of injuries

The lower extremity was the most common site of injury for all injury types. The head and neck accounted for 25% of acute competition injuries and 18% of all injuries, while the knee was the most commonly-injured area (table 2).

Football 7-a-side

Injury incidence proportion and incidence rate The eight teams participating each consisted of a squad of 12 players (n= 96 players). Thus, with data collection over 14 day period the total exposure for training and competition was 1344 athlete-days.

During this period 14 injuries were documented giving an IP of 14.6 injuries per 100 athletes (95% CI; 7.5-21.6) and an IR of 10.4 injuries per 1000 athlete-days (95% CI; 5.4-15.5) (Table 3). There was a trend toward a higher injury rate in the 26-34 year-old age group compared with younger and older athletes, but this did not reach statistical significance.

Seven of the 14 reported injuries (50%) resulted in less than one day of time lost from training or competition. Five injuries resulted in more than one day lost from training and competition. Time loss was not reported for two of the injuries (Table 3).

Acute vs. overuse injuries

The most common onset of injury was acute traumatic in nature (71% of all injuries), followed by acute-on-chronic injuries (22%). There was only one chronic overuse injury

(7.1% of all injuries). For all acute injuries, consisting of acute traumatic injuries combined with acute-on-chronic injuries, the IR was 9.7 (95% CI 4.8 – 14.6), which was significantly more common than chronic injuries (IR 0.7, 95% CI 0.0 – 2.2). The majority of injuries occurred during competition (64% of all injuries) (Table 3).

Anatomical location of injuries

Table 4 outlines the anatomic locations of injuries for the athletes. The lower extremity was involved in 12 out of 14 injuries (86% of all injuries). The ankle (36% of all injuries) and knee (29%) were the most commonly injured regions of the body. Five injuries (36% of all injuries) were due to contact with another athlete.

DISCUSSION

This is the first study to prospectively examine injury rates and characteristics of injury in the sport of football at the Paralympic Games. We demonstrate an injury IR of 22.4 injuries per 1000 athlete-days in football 5-a-side and 10.4 injuries per 1000 athlete-days in football 7-a-side. Prior to the London Games injury patterns in football 5-a-side have only been reported in one study[20]. In this study, a group of 13 players were followed over a five-year period playing in five international competitions for one nation. Not all athletes played in all competitions. Only injuries that occurred during competition were documented. Twenty-three matches occurred during the period of the study and 11 of the 13 players experienced some form of injury (incidence proportion 84.6%). A total of 35 injuries were documented (mean injury frequency = 2.7 injuries per athlete over 5 years

and 0.12 injuries per match). Traumatic injuries (80%) were more common than overuse injuries (20%) and the highest distribution of injuries involved the lower extremity (80%), followed by the head (8.6%), spine (5.7%) and upper extremity (5.7%). Although the study is limited by the small number of participants from only one nation, it does set a benchmark for comparison. To the authors' knowledge, there have been no studies examining football 7-a-side exclusively.

Researchers with the International Paralympic Committee have successfully demonstrated a decrease in injury rates in the sport of sledge ice hockey through rules changes based on prospective analysis of injury characteristics[6]. This same model can be applied to Paralympic football given the increased knowledge of injuries seen in this sport.

Football 5-a-side

In total, nearly 50% of football 5-a-side players with a visual impairment sustained an injury over the 14 day Games period. Our findings were consistent with the Brazilian study[20] showing that the most commonly injured body region is the lower extremity. Head and neck injuries accounted for 25% of acute injuries during competition and 18% of all (acute and chronic) injuries compared to 8.6% in matches in the Brazilian study. The nature of the way the game is played makes patterns of injury different from traditional football. VI athletes play with a more upright posture compared to non-VI soccer athletes that may expose them to collisions of the head. Additionally, a lack of vision reduces the athlete's ability to brace or block their head when anticipating an oncoming blow. This

finding contrasts with the able-bodied football population and highlights the susceptibility of the head and neck to injury in VI athletes and forms of protective headgear could be examined for injury prevention.

In this study over 60% of competition-related injuries were reported as associated with foul play, which is double the percentage previously identified in elite able-bodied football (29%)[21]. To avoid collisions there is an important communication rule in VI football which players must abide by. It is the duty of the player without the ball to say the word “voy” clearly and in a timely fashion each time he or she is moving towards the ball. The expression "voy" is a universally known expression in the world of VI football, adopted from Spanish and meaning "I go." Gabriel Mayr’s diploma thesis states that this rule ‘gives the present ball holder the certainty that he or she learns in advance that an opponent is approaching. If the player does not say "Voy", the referee should punish the team with a foul[22].’ It is crucially important that referees apply the laws strictly and correctly to try and prevent player collisions. From our data, it would appear that the most effective preventive strategy would be to encourage strict enforcement of these rules.

Football 7-a-side

The incidence rates for the athletes in our study appear to be lower than those of elite able-bodied football players[1,4,5], although they follow the trends described in able-bodied football of injuries occurring more commonly in competition and not resulting in significant time-loss. The lower incidence of injury compared to able-bodied athletes has

been shown in ambulant athletes with cerebral palsy in the sport of athletics (Blauwet, unpublished observation) as well, although the reasons for these differences have not been elucidated. It should also be noted that several studies examine male and female able-bodied football players, while football 7-a-side has only male participants. Females have demonstrated similar rates of injury in football compared to males in the Olympic Games[4].

Several previous studies have examined injuries in para-athletes, but have not provided an in-depth examination of football 7-a-side. Recently, Willick et al. reported on injury incidence rates from all sports using the same dataset, and showed that football 7-a-side athletes sustained injuries at a rate similar to that of all sports combined[9]. Derman et al.[19] demonstrated that for all summer Paralympic sports, upper limb injuries were more common during these Games than lower limb injuries; this contrasts with our sport-specific findings, which emphasizes the importance of identifying sport-specific injury patterns. Our results suggest that preventive strategies should focus on prevention of lower extremity injuries, particularly of the ankle and knee, and moreso in the 26-34 age group. Proprioceptive ankle training, or bracing/taping, which have both been demonstrated to be an effective method in the prevention of ankle sprains[23], may be an effective means of preventing ankle injuries in this cohort.

Football athletes with central neurologic injury such as cerebral palsy may carry a greater risk of muscle strain and injury due to spasticity and weakness, and are heterogeneous in their abilities and clinical presentation[24,25]. Athletes with cerebral palsy have been shown

to sustain soft tissue injuries and lacerations more often than athletes with other physical impairments[26]. Nyland et al.[27] demonstrated that Paralympic athletes with cerebral palsy sustained similar rates of injuries of the knee, shoulder, leg/ankle, and hand/finger when accounting for all sports.

This study has limitations common to many sports injury epidemiology studies conducted at major games. Despite the large size of the Games, there were still fewer than one hundred athletes participating in each football 5-a-side and football 7-a-side. Therefore, subtle findings may not have been detected. It is possible that the injury IR is underestimated as data collection is dependent upon medical personnel entering a daily report of injuries. It is impossible to ensure that the NPC medical personnel reported all injuries assessed in their medical stations in the Paralympic Village. To estimate overall injury rates, denominator data has been estimated based on number of athletes and 14 days of athlete exposure at the London Paralympics. As such, injury rates may be underestimated if all athletes were not at risk of injury throughout the entire games period. In addition, injuries that occurred in competition may have been more likely to be reported compared with non-competition injuries, as competition injuries are often more significant and memorable and occur within the proximity of medical personnel. Furthermore, the available data does not allow for determination of an association between injury and other potential causative factors such as player position, field surface, time of injury during a match, and whether or not an injury affected an athlete's spastic or paretic limb versus a limb unaffected by their neurologic condition. The low number of injuries also does not

allow for a multivariate analysis, which could be used to determine independent risk factors for injury. To further characterize mechanisms of injury, future research should include analysis of injuries captured on video to elucidate specific mechanisms. Finally, the estimation of time loss to define injury severity could be inaccurate as it was guessed by the medical professional that completed either the LOCOG medical encounter form or the web based injury survey as the estimated number of training and competition days that an athlete was likely to lose based on his initial presentation. In the future, improved data collection methodology will aid the ability to overcome some of these limitations and provide for more informative injury data. Specifically, further refinements in the injury surveillance system are needed to capture more detailed information about specific diagnoses and mechanisms of injury.

CONCLUSION

To our knowledge, this is the first cohort study examining injury IR and factors associated with injury in football at the Paralympic Games. Football 5-a-side recorded the highest incidence of injury among all of the twenty summer Paralympic sports competed at the London 2012 Paralympic Games, while football 7-a-side had an incidence rate similar to that of all sports competed at the Games. For football 7-a-side, athletes sustained primarily acute injuries during competition. Of the injuries sustained, 50% resulted in less than one day of time lost from training and competition. The most commonly affected injury locations for athletes were the knee and ankle. For football 5-a-side, the majority of injuries occurred in competition and were deemed to be related to foul play resulting in

collisions, which deserves further in-depth evaluation of illegal play and more rigid application of the rules by referees. There may be a role for protective headgear if the high incidence of head and neck injuries (25%) during competition is borne out in further studies.

ACKNOWLEDGEMENTS

The authors wish to extend their most sincere thanks to all members of LOCOG medical services who assisted with data collection, to include LOCOG Chief Medical Officer Dr. Richard Budgett. The authors also with to thank all NPC medical personnel who participated in data collection. Special recognition is deserved by Dr. Oriol Martinez and Dr. Norma Angelica Patino Marques for their leadership on the IPC Medical Committee, as well as Ms. Cristiani Gomes, Dr. Pia Pit-Grosheide, Dr. Harry Benjamin-Laing, Ms. Janey Beven, and Mr. Greg Vice, whom were all instrumental in study coordination. Ms. Esme Jordaan additionally deserves thanks for her assistance with statistical analysis. The authors also wish to thank Acer for donating 20 tablet computers utilized as an incentive to team physicians for study participation. This study was approved and supported by the International Paralympic Committee (IPC). We would also like to thank the scores of health care providers from LOCOG and the national Paralympic Committee delegations who assisted with data collection.

REFERENCES

1. Engebretsen L, Soligard T, Steffen K, et al. Sports injuries and illnesses during the London Summer Olympic Games 2012. *Br J Sports Med.* 2013;47(7):407-414.

2. Junge A, Dvorak J. Injury surveillance in the World Football Tournaments 1998-2012. *Br J Sports Med.* 2013;47(12):782-788.

3. Junge A, Dvorak J, Graf-Baumann T, Peterson L. Football injuries during FIFA tournaments and the Olympic Games, 1998-2001: development and implementation of an injury-reporting system. *The American journal of sports medicine.* 2004;32(1 Suppl):80s-89s.

4. Junge A, Langevoort G, Pipe A, et al. Injuries in team sport tournaments during the 2004 Olympic Games. *The American journal of sports medicine.* 2006;34(4):565-576.

5. Theron N, Schwellnus M, Derman W, Dvorak J. Illness and injuries in elite football players--a prospective cohort study during the FIFA Confederations Cup 2009. *Clin J Sport Med.* 2013;23(5):379-383.

6. Webborn N, Willick S, Emery CA. The injury experience at the 2010 winter paralympic games. *Clin J Sport Med.* 2012;22(1):3-9.

7. Webborn N, Willick S, Reeser JC. Injuries among disabled athletes during the 2002 Winter Paralympic Games. *Med Sci Sports Exerc.* 2006;38(5):811-815.

8. Schwellnus M, Derman W, Jordaan E, et al. Factors associated with illness in athletes participating in the London 2012 Paralympic Games: a prospective cohort study involving 49,910 athlete-days. *Br J Sports Med.* 2013;47(7):433-440.

9. Willick SE, Webborn N, Emery C, et al. The epidemiology of injuries at the London 2012 Paralympic Games. *Br J Sports Med.* 2013;47(7):426-432.

10. International Blind Sports Federation. FUTSAL LAWS OF THE GAME 2009-2013. 2009; http://www.ibsasport.org/sports/football/rules/. Accessed 2013 Nov 12, 2013.

11. Committee IP. Layman's Guide to Paralympic Classification. 2015; http://www.paralympic.org/sites/default/files/document/120716152047682_classificationguide_2.pdf. Accessed 2/17/2015, 2015.

12. Committee IP. Football 7-a-side. 2015; http://www.paralympic.org/football-7-side. Accessed 2/17/2015, 2015.

13. Webborn N. Lifetime injury prevention: the sport profile model. *Br J Sports Med.* 2012;46(3):193-197.

14. Muckle DS. Injuries in professional footballers. *Br J Sports Med.* 1981;15(1):77-79.

15. Fuller CW, Hawkins RD. Developing a health surveillance strategy for professional footballers in compliance with UK health and safety legislation. *Br J Sports Med.* 1997;31(2):148-149; discussion 150.

16. Fuller CW, Junge A, Dvorak J. Risk management: FIFA's approach for protecting the health of football players. *Br J Sports Med.* 2012;46(1):11-17.

17. Hagglund M, Walden M, Bahr R, Ekstrand J. Methods for epidemiological study of injuries to professional football players: developing the UEFA model. *Br J Sports Med.* 2005;39(6):340-346.

18. Walden M, Hagglund M, Ekstrand J. UEFA Champions League study: a prospective study of injuries in professional football during the 2001-2002 season. *Br J Sports Med.* 2005;39(8):542-546.

19. Derman W, Schwellnus M, Jordaan E, et al. Illness and injury in athletes during the competition period at the London 2012 Paralympic Games: development and implementation of a web-based surveillance system (WEB-IISS) for team medical staff. *Br J Sports Med.* 2013;47(7):420-425.

20. Magno E Silva MP, Winckler C, Costa E Silva AA, Bilzon J, Duarte E. Sports injuries in paralympic track and field athletes with visual impairment. *Med Sci Sports Exerc.* 2013;45(5):908-913.

21. Hawkins RD, Fuller CW. Risk assessment in professional football: an examination of accidents and incidents in the 1994 World Cup finals. *Br J Sports Med.* 1996;30(2):165-170.

22. Mayr de Oliveira Silva G. *Football for the Blind*: Aplikovaných Pohybových Aktivit, Palacky University; 2008.

23. Schiftan GS, Ross LA, Hahne AJ. The effectiveness of proprioceptive training in preventing ankle sprains in sporting populations: a systematic review and meta-analysis. *Journal of science and medicine in sport / Sports Medicine Australia.* 2015;18(3):238-244.

24. Carroll KL, Leiser J, Paisley TS. Cerebral palsy: physical activity and sport. *Current sports medicine reports.* 2006;5(6):319-322.

25. Damiano DL, Abel MF. Functional outcomes of strength training in spastic cerebral palsy. *Arch Phys Med Rehabil.* 1998;79(2):119-125.

26. Patatoukas D, Farmakides A, Aggeli V, et al. Disability-related injuries in athletes with disabilities. *Folia medica.* 2011;53(1):40-46.

27. Nyland J, Snouse SL, Anderson M, Kelly T, Sterling JC. Soft tissue injuries to USA paralympians at the 1996 summer games. *Arch Phys Med Rehabil.* 2000;81(3):368-373.

449 TABLES

450 Table 1: Injury incidence proportion (IP) (injuries per 100 athletes) and incidence rate (IR)
451 (injuries per 1000 athlete-days) with 95% confidence intervals (CI) at the London
452 Paralympic Games for the sport of football 5-a-side during the pre-competition and
453 competition period (14 days). AT = acute traumatic injury, CO = chronic overuse injury,
454 AOC = acute on chronic injury.

	Number of athletes	**Number of injuries**	**IP**	**IR**	**IR 95% CI**
Overall	70	22	31.4	22.4	14.1 - 33.8
Position					
Goalkeepers (sighted)	14	0	0	0	0-18.6
Outfield (visually impaired)	56	22	39.3	28.1	17.7 - 42.2
Timing of sport-related injuries					
Prior to Games	56	7	12.5	8.9	3.6-18.3
During Games – in training	56	6	10.7	7.7	2.8-16.7
During Games – in competition	56	8	14.3	10.2	4.4-20
During Games – out of sport	56	1	1.8	1.3	0-3.8
Acuity of injury					

AT	56	12	21.4	15.3	7.6 – 23.0
AOC	56	5	8.9	6.4	2.1-14.8
CO	56	5	8.9	6.4	2.1-14.8

455

Table 2: Injury incidence rate (IR) (injuries per 1000 athlete-days) by anatomical region at the London Paralympic Games for the sport of football 5-a-side (n=56 outfield players and excluding goalkeepers) during the pre-competition and competition period (14 days).

Anatomical region	**Number of injuries**	**Proportion of all injuries**	**IR**
Knee	4	18.2%	5.1
Lower leg	3	13.6%	3.8
Head/face	3	13.6%	3.8
Trunk/abdominal	2	9.1%	2.6
Foot	2	9.1%	2.6
Ankle	2	9.1%	2.6
Wrist/hand	1	4.5%	1.3
Shoulder	1	4.5%	1.3
Neck	1	4.5%	1.3
Lumbar spine	1	4.5%	1.3
Hip/groin	1	4.5%	1.3
Totals	22	100%	28.1

460 Table 3: Injury incidence proportions (IP) (injuries per 100 athletes) and incidence rates
461 (IR) (injuries per 1000 athlete-days) at the London Paralympic Games for the sport of
462 football 7-a-side during the pre-competition and competition period (14 days). IRR =
463 incidence rate ratio.

	Number of athletes	**Number of injuries**	**IP**	**IR**	**IR 95% CI**
Overall	96	14	14.6%	10.4	5.4 - 15.5
Age group					
13-25	48	4	8.3%	6.0	0.4 - 11.5*
26-34	45	10	22.2%	15.9	7.2 - 24.5*
35-67	3	0	0%	0	-
Initial timing of sport-related injuries					
Prior to Games	96	1	1.0%	0.7	0 - 2.2
During Games – in training	96	3	3.1%	2.2	0 - 4.7
During Games – in competition	96	9	9.4%	6.7	2.5 - 10.9
Acuity of injury					

Acute traumatic	96	10	10.4%	7.4	3.1 - 11.8
Acute on chronic	96	3	3.1%	2.2	0 - 4.7
Chronic overuse	96	1	1.0%	0.7	0 - 2.2
Time-loss injuries					
0-1 days missed	96	7	7.3%	5.2	1.5 - 8.9
More than 1 day missed	96	5	5.2%	3.7	0.5 - 6.9
Time not specified	96	2	2.1%	1.5	

464 *IRR between youngest age groups = 2.7 (95% CI; 0.8-11.8)

Table 4: Injury incidence rate (IR) (injuries per 1000 athlete-days) by anatomical region at the London Paralympic Games for the sport of football 7-a-side during the pre-competition and competition period (14 days).

	Number of injuries	**Proportion of all injuries**	**IR**
Ankle	5	35.7%	3.7
Knee	4	28.6%	3.0
Thigh	1	7.1%	0.7
Lower leg	1	7.1%	0.7
Toe	1	7.1%	0.7
Head/face	1	7.1%	0.7
Undefined	1	7.1%	0.7
Totals	14		10.4