Injury epidemiology in Australian male professional soccer

Abstract

Objective: To describe the injury epidemiology of the Australian male professional soccer league (A-League) over 6 consecutive seasons. *Design*: Prospective observational cohort study. *Methods*: Match-loss injury data was collected from each A-League club (n=10) for each competition match (n=27/season) over 6 seasons (2012/13 to 2017/18). Injuries were collected weekly through a standardised protocol and were classified by setting, mechanism, severity, the type and location on the body. Generalised Linear Models were used to estimate the injury incidences (injury/round/season), whilst rate ratios were reported for total injuries and within abovementioned injury classifications. *Results*: Overall injury incidence was not significantly different ranging from 4.8 (95%CI:4.1-5.8) to 6.7 (95%CI:5.8-7.8) between seasons 2012/13 to 2017/18 ($p>0.05$). Match injuries remained stable whilst training injuries decreased across the 6 seasons (exp(β) 0.59[95%CI:0.36-1.0]; $p=0.04$). Respectively, contact and non-contact injuries were not significantly different across the 6 seasons, although non-contact injuries were more common than contact injuries ($p>0.05$). Mild severity injuries decreased (exp(β) 0.64 [95%CI:0.4-0.9];$p=0.02$), whilst moderate severity injuries increased (exp(β) 1.7 [95%CI:1.0-2.8];$p=0.04$) in season 2017/18 compared to 2012/13. The most common injuries were at thigh (23-36%), of which the majority were hamstring injuries (54%-65%) of muscle/tendon type (50-60% of total injuries/season). Injuries remained stable across the seasons by type and location ($p>0.05$ and $p>0.05$, respectively). *Conclusions*: Injury rates, mechanisms, locations and types have remained relatively stable over recent seasons of the A-League. Current Australian professional soccer league medical practices may have contributed to the stability of injury rates.

Key Words: Incidence, Injury Prevention, Football, Team Sport

Practical Implications

- Injury proportions and injury trends over multiple seasons within a league allows for more accurate interpretation of injury epidemiology.
- Resources should continue to be allocated to prevent non-contact muscle/tendon training and match injuries at the thigh particularly the hamstring in the A-League.
- Although most common injury types and location are of interest for stakeholders, competition organisers and medical staff should still be aware of the variation in less common injuries.

Introduction

Injuries result in adverse medical, socioeconomic and performance effects on players, clubs and leagues in professional soccer, highlighting the importance of continued focus on injury prevention strategies.[1] As part of this process, systematic studies of injury epidemiology are required to prioritise highly prevalent and severe injuries and understand patterns of incidence to drive appropriate intervention foci.[2] League-based injury epidemiology studies have reported overall injury incidences between 5-8/1000 playing hours, with training injuries (2-5/1000 playing hours) commonly lower than match-based injury incidence rates (30-60/1000 playing hours).[3, 4] Few soccer injury epidemiology studies have reported multi-season data from locations outside of Europe, making it difficult to deduce either seasonal injury trends, or trends from other continents. The lack of multi-season, geographical-specific, league-based injury data from the Asian region has prompted the Asian Football Confederation (AFC) Medical Committee to call for greater reporting of injury surveillance from member federations.[5]

Longitudinal injury epidemiology analysis can profile the patterns between risk factors and incidence. In the Japanese Premier League over 15 seasons (1993 to 2007 seasons), injury incidence had a non-significant decrease ($p=0.118$).[6] Stable overall, match and training injury incidence were also reported in 23 Union of European Football Associations (UEFA) teams between seasons 2001/02 and 2007/08.[7] Further, in the aforementioned epidemiology report muscle/tendon injuries at the hamstrings were most common, showing an increase of 2.3% per year in a further analysis of 36 UEFA Clubs.[8] However, the contribution of these injuries to the overall injury incidence vary between leagues and are contrary to the generally stable overall injury incidence rates.[8, 9] Hence league-specific injury epidemiology over multiple seasons is important to guide the investigation of injury mechanism and aetiology.

The Australian male professional soccer league (A-League) has been active for 13 consecutive seasons in its current guise; though injury incidence and characteristics have only been reported in the research literature once, for seasons 2008/09 to 2012/13.[10] From this work, time-loss injuries peaked at a total of 202 injuries in the 2010/11 season before decreasing to ~160 total injuries in the following two seasons. Time-loss injuries also showed a similar trend, peaking with 1100 missed matches in season 2010/11 and reducing to 760 missed matches in season 2011/12. Of note, despite this novel reporting, the study is limited by a lack of comparable injury rate or incidence rate ratio. Additionally, the injury count was limited to hamstring, groin, knee and ankle injuries not reflecting the full extent of injuries in this competition. Hence an updated A-League injury epidemiology, inclusive of all injury types from standardised collection methods is necessary. With such an update, national league stakeholders can evaluate previous practices to inform effectiveness of injury prevention in future seasons.

Given the lack of comparable Australian injury data and importance of injury epidemiology data to guide effective injury prevention, injury epidemiology reporting from recent seasons of the A-League is necessary. Therefore, this study aims to 1) report the injury incidence in the A-League between 2012/13 to 2017/18 seasons, and 2) describe the frequency of injury type, location, mechanism, and number of missed matches in these 6 seasons.

Methods

A prospective cohort study of 421 players in the A-League was undertaken between seasons 2012/13 to 2017/18. A standardised injury surveillance system collected injury data from all A-League teams (n=10) for 6 consecutive seasons. Each season consisted of 27 matches (October to April) from the A-League competition, equating to 810 matches played over the 6 seasons. A full-time physiotherapist of each team recorded injury data on a daily basis and reported weekly injury surveillance data using the Football Federation Australia Injury Surveillance spreadsheet, which was forwarded to the Injury Surveillance Officer. Given reporting of data is part of medical policy, compliance of submitting injury surveillance data was 100%. Each player signed a release of medical records form as part of their A-League contract under the Collective Bargaining Agreement. Permission for the use of the medical data was granted by Football Federation Australia. The study design was approved by the Human Research Ethics Committee (UTS REF: ETH18-2324).

A time-loss injury definition was adopted from Fuller et al.[11] with specific references to A-League matches in that '*any physical complaint requiring medical attention resulting in a missed A-League match'*. Injury surveillance sheets collected when an injury occurred and if they occurred in an official A-league match, training or from an 'other' setting. An 'other' injury is defined as an injury occurring outside of an official A-League match or training; however, still resulting in a missed official A-League match. All match, training and 'other' injuries were included in the overall injury incidence. The Injury Surveillance spreadsheet also recorded number of missed matches, type, location and mechanism of injury. Injuries were divided into a severity category based on the number of consecutive missed matches – mild (1 missed match), moderate (2 – 4 missed matches) and severe (5 or more missed matches).

Injuries were dichotomised into contact or non-contact mechanism; where contact injuries are those resulting from physical contact with another player or object. Non-contact injuries refer to an injury event resulting from an athlete imposing excessive force within their body .[12] Classification for injury location and type groupings were based the FIFA Assessment and Research Centre Injury Consensus Group statement.[11] All injuries were recoded from the Sport Medicine Diagnostic Coding System to the Orchard Sports Injury Classification System by the injury surveillance officer with consultation of 2 sports physicians and a physiotherapist.[12, 14]

Injury were aggregated to counts, overall and by subgroups (setting, mechanism, type and location), across the league for each match (n=27 matches/season) and per season (n=6). Injuries were expressed per rounds as exposure in terms of time played was not collected. Season 2012/13 was used as the reference season. Trends in total injuries by season were evaluated using Poisson regression models. An assessment of over-dispersion was made for each model by comparing the mean and variance and, if found, a quasi-Poisson model was used. Models with a continuous representation of season tested for a linear trend, while a categorical representation of season was used to evaluate possible non-linear trends in injury. Interaction models with pairwise comparisons were used to assess differences in injury setting, mechanism, type and location across the 6 season period. The incidence of concussion, quadriceps/lateral thigh, hamstrings and anterior cruciate ligament injuries were further analysed over the 6 seasons in separate models due to high prevalence and severity of injury consequence. Incidence estimates per match per season and 95% confidence intervals (CI) for the 6 seasons were reported. Rate ratio (RR) was reported by exponentiating the intercept and slopes. A rate change of less than 1 resulted in injury incidence reduction whilst

a rate change above 1 related to an increase in injury incidence. All analysis was conducted in the R statistical language with the packages 'MASS' and 'emmeans'.[12, 16, 17]

Results

A total of 917 injuries were recorded from 421 players competing in the A-League over the 6 seasons were included in the analysis. The total number of injuries in the 6 consecutive seasons were 164, 152, 182, 121,146 and 151, respectively, between 2012/13 to 2017/18. The estimated total injury incidence/round ranged between 4.8 (95%CI:4.1-5.8) to 6.7 (95%CI:5.8-7.8), without any significant differences between seasons (Figure 1A; $p>0.05$). Further, the occurrence of an injury was unaffected by the week within a season (exp(β) 0.99 (95%CI:0.98-1.00); $p=0.119$).

Over 6 seasons of analysis, injuries were most commonly sustained in a match setting ranging between 3 (95%CI:2.4-3.6) and 3.5 (95%CI:2.8-4.3) per round/season without differences between seasons (Figure 1B; $p>0.05$). Injury rates in training sessions significantly decreased from 3.0 (95%CI:2.3-3.8) to 1.8 (95%CI:1.4-2.4) per round/season between 2012/13 and 2016/17 (exp(β) 0.59 [95%CI:0.36-1.0]; $p = 0.04$). The least common injuries resulting in missed A-League matches occurred from 'other' settings; with a range between 1 (95%CI:0.5-1.9) and 1.9 (95%CI:1.3-2.7) per round/season. Injury incidences were not significantly different for match and other settings between the 6 seasons ($p>0.05$).

When considering the mechanism of injury, non-contact injuries (range; 3.3[95%CI:2.7-4.1]-5.1[95%CI:4.3-6.0] injuries per round/season) were more common in all 6 seasons than contact injuries (range: 1.8[95%CI:1.3-2.4]-2.3[95%CI:1.8-2.9] injuries per round/ season).

Although no differences are reported between seasons for contact ($p>0.05$) and non-contact injuries, respectively ($p>0.05$).

The total number of missed matches were 471, 551, 714, 415, 492 and 505 between season 2012/13 and 2017/18. When injuries where categorised into their severity groups, mild injuries significantly decreased (exp(β) 0.64 (95%CI:0.4-0.9); $p=0.02$) and moderate injuries increased (exp(β) 1.7 (95%CI:1.0-2.8); $p=0.04$). Severe injuries were not significantly different across the 6 seasons ($p>0.05$).

The most common location of injury was the thigh (23-36%). From 2012/13 to 2013/14, the second most common injury location was at the hip/groin (16-18%), however, knee injuries were equally the second most common injury in 2014/15 (15%). Knee injuries became second most common injury in 2015/16 (16%) and 2016/17 (16%) followed by lower leg/Achilles Tendon injuries in 2017/18 (16%). There were no significant differences between seasons within each injury location ($p>0.05$; Table 1). Subgroups of injury location showed no significant differences between seasons for concussions, which made up 20-75% of all head/face injuries per season. Hamstring injuries (54%-65%) made up the majority of thigh injuries and anterior cruciate ligament injuries made up 14%-29% of all knee injuries. Similarly, Muscle/Tendon (50-60%) and Joint/Ligament (21-34%) injuries were most commonly sustained though, no significant differences are reported between seasons for each injury type ($p>0.05$; Table 2).

Discussion

The aim of this study was to quantify the incidence of injuries, setting in which they occurred, mechanisms, types, locations and their severity in Australia's male professional soccer league

(A-League). The main finding of this study was that the overall injury incidence remained stable over the most recent 6 consecutive seasons, in part explained by no change between seasons when injuries were categorised by mechanism, type or location. As expected and comparable with European leagues, muscle/tendon injuries of the thigh region were the most common injury type and locations, which also remained stable over the 6 seasons analysed. Further, mild injuries significantly decreased in 2017/18, yet moderate injuries increased in 2017/18 compared to the 2012/13 season. Collectively, injuries at the league level seem stable.

Analysis of injury trends can be used to evaluate the effectiveness of injury prevention strategies. The stability of injury incidence rates in the present study is consistent with longitudinal soccer injury epidemiology reported in the UEFA and J-League studies.[6, 7] Specifically, over 15 seasons (1993 to 2007 seasons), injury incidence in the J-League had a gradual, but non-significant decrease (p=0.118).[6] Similarly, teams in UEFA competitions also reported overall stable, match and training injury incidence rates between seasons 2001/02 and 2007/08.[7] In the present study training injuries significantly decreased in 2016/17 despite remaining stable across the other seasons. Despite similar season-based trends in the present study, the injury incidence rates are not comparable due to the inconsistent nature of incidence calculation. However, the present data is comparable to the previous A-League results where Gouttebarge et al.[10] reported an injury count range of 4.7 - 7.4 injuries per 27 rounds between Season 2008/09 to 2012/13. These findings compare favourably to the 4.8 [95%CI:4.6-6.4] to 6.7 [95%CI:5.8-7.8] in 2012/13 to 2016/17 evident in the current study. That said, Gouttebarge et al. [10] also reported no differences between season injury counts; although, missed matches significantly decreased in the 2 consecutive seasons following Season 2010/11. Reasons for the observed stability are speculative, though in the context of

the A-League, Gouttebarge et al. [10] suggested that the introduction of 'Minimum Medical Standards' by the governing body contributed to a lower number of injuries after 2011, and may further explain the current results. Another suggested hypothesis is the interaction of increasing injurious demands e.g. high-speed running distance, balanced with growing effectiveness of injury prevention strategies.[18, 19, 20, 21] Such stability in injury rates following decreased injury trends in 2011/12 highlights the importance of league-wide longitudinal injury surveillance to inform ongoing practice.

This is the first study to present the injury trend per mechanism whereby non-contact injuries were consistently more common in all seasons and stable across 6 seasons. Comparatively, a high proportion of non-contact injuries is consistent with reports from the Hong Kong Premier League over 1 season, [22] while only 5% of muscle injuries were the result of foul play in 51 European teams.[7] It is plausible that injuries are dependent on club circumstances, which may vary significantly between and within clubs e.g. coaching and training style, or provisions for preventative care. Consequently, between and within club variances should be established to confirm the injury trend and allow clubs to compare between their own seasons and to the rest of the league. It is worth mentioning that all A-League clubs are bound to the Minimum Medical Standards. Minimum Medical Standards mandates multiple components of medical infrastructure and medical provisions serviced to teams. Knowledge of the injury prevention strategies implemented and/or changed during these seasons would be informative for effective injury prevention practices.

Reporting injury incidence (i.e. number of injuries per period of time) only partially describes the injury situation within a league and can be misleading.[1] Thus, reporting injuries with respect to the severity (i.e. resulting missed matches) is important given ensuing match

198 unavailability is associated with team performance.[4, 23] The current findings show a
199 cumulative range of 415 to 714 missed matches/season, representing a reduction in missed
200 matches reported in previous research on the A-League. [10] A reduction in missed matches in
201 the present study is unexpected given the wider inclusion of injury types, although this may
202 be explained by the overall reduction in injury count after 2011/12. Further analysis in the
203 present study reports a decrease in mild injuries, whilst moderate injuries increased over the
204 6 seasons analysed. The interpretation of such findings emphasises the dissonance in injury
205 incidence data and requires inclusion of severity to ensure appropriate understanding. [24] That
206 is, despite higher prevalence of hamstrings muscle injuries than anterior cruciate ligament
207 tears, the burden (expressed by days lost due to injury) was 8-fold greater equalling to a
208 similar risk matrix.
209
210 Analyses of injury locations and type can guide the development of prevention programs and
211 allocation of resources.[2] Consistent with other professional soccer injury epidemiology
212 research, injuries were most commonly of muscle/tendon type and at the thigh. The
213 proportion of muscle/tendon injuries in the A-League (50-55%) are comparable to the 54%
214 of muscle/tendon injuries in the thigh location reported in a one season injury epidemiology
215 study in the La Liga.[3] In the current study, injury incidences in all locations remained constant
216 across the 6 seasons. Conversely, an annual mean rate increase of 2.3% in hamstring injuries
217 was reported over 13 seasons in 36 UEFA teams until 2014.[8] The hip/groin location was the
218 second most common site of injury (8-18%) in the present data set. Comparatively, a 15-year
219 study of 47 European teams also reported a decrease in hip and groin injuries by an average
220 of 2% and 3% each season, respectively, despite the burden of both injuries remaining
221 constant.[9] Novelty in the present findings is the variability of injury locations commonality
222 between seasons, despite all location categories remaining stable across the 6 seasons. That

is, the second and third most common injuries varied between hip/groin, knee, lower leg/Achilles tendon and ankle categories without separate linear trends. Longitudinal injury analysis provides context to the differences in the most common injuries; the ankle is the predominant injury location in one season of the Hong Kong Professional League.[22] It could be that the league-level injury incidence may erroneously generalise the injury trends, instead, there is high variability between seasons that is not detected by the current methods of reporting. Nonetheless, between-season injuries analysis should consider variation between locations and include predictive parameters such as workloads mentioned previously for future studies.

Limitations due to methodological differences with previous multi-season league-based injury epidemiology studies should be acknowledged. Differences in reported data of the overlapped season (Season 2012/13) may be due to the different definition and data collection procedures.[10] The current study defines an injury if the event missed an official A-League match. The consequence of this definition is the underestimation of injuries with a short severity of less than 5-6 days when playing one match per week. Additionally, recurrent, preseason and off-season injuries were not considered in the injury surveillance. It is therefore difficult to gauge the size of the injury situation, given the influence of previous injury on recurrent injury and importance of training availability for exposure to prophylactic chronic high training loads.[25, 26] Additionally, training and match exposure times were not collected in the injury surveillance system used in this study thus injury incidence per 1000 hours of playing exposure could not be reported. Though the reported injury rates in the present study is difficult to compare to other leagues; however, comparison of injury counts and rates to evaluate the Australian injury situation is appropriate given Gouttebarge[10] also reported injuries with the same 27 round exposure. It important to remove the confounding effect of

different exposure data and limitations of injury definition in collecting injuries to understand the injury risk factors.[27] Such suggestions will allow Australian male soccer injury epidemiology to be comparable with other leagues and improve accuracy to reflect the state of injuries within the A-League. It is worth noting that the limitations of this present study have been addressed in the current FFA Injury Surveillance System by capture training and match exposure and training and matches missed. It is envisaged that these changes will allow for a comparable Australian injury incidence for future evaluation.

Conclusion

Overall injury incidence rate and injury characteristic injury incidences trends have remained stable over 6 seasons in the A-League. However, training and mild injuries decreased whilst moderate injuries increased. The stability of injuries is coupled with variability in the most common injury locations and types. The findings of the present study demonstrate the most common injuries and injury trends in the A-League, which provides guidance for the injury prevention and treatment of professional male club soccer players.

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Disclosure of Interest

(Removed for review process).

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Figure 1. Injury trends between season 2012/13 and 2016/17 for A) Total injuries, B) Injuries by Setting, C) injury by mechanism; and, D) injury incidence by severity group.

Figure 1. B) Δ =significantly less training injuries than 2012/13 (p=0.04); Figure 1. D) Δ =significantly more moderate severity injuries than 2012/13 (p=0.004); O = significantly less mild severity injuries than 2012/13 (p=0.02)

Table 1. Injury count (n), percentage distribution (%), injury rate (95%CI) and rate ratio (RR) by location per season.

	2012/13*		2013/14			2014/15		
Location	N (%)	Injury Rate (95%CI)	n (%)	Injury Rate (95%CI)	RR	n (%)	Injury Rate (95%CI)	RR
Head/Face	5 (3)	1.0 (0.4-2.4)	8 (5)	1.1 (0.6-2.3)	1.1 (0.4-3.8)	2 (1)	1.0 (0.3-4.0)	1.0 (0.1-4.6)
Concussion	3 (38)	1.0 (0.3-3.1)	4 (57)	1.0 (0.4-2.7)	1.0 (0.2-5.1)	2 (14)	1.0 (0.3-4.0)	1.0 (0.1-6.0)
Neck/Cervical Spine	0 (0)	0 (0-0)	0 (0)	0 (0-0)	0 (0-0)	0 (0)	0 (0-0)	0 (0-0)
Shoulder/Clavicle	3 (2)	1.0 (0.3-3.1)	3 (2)	1.0 (0.3-3.1)	1.0 (0.2-5.4)	10 (5)	1.1 (0.6-2.1)	1.1 (0.3-4.9)
Elbow	0 (0)	0 (0-0)	0 (0)	0 (0-0)	0 (0-0)	1 (1)	1.0 (0.1-7.1)	0 (0-0)
Forearm	0 (0)	0 (0-0)	0 (0)	0 (0-0)	0 (0-0)	0 (0)	0 (0-0)	0 (0-0)
Wrist	1 (1)	1.0 (0.1-7.1)	0 (0)	0 (0-0)	0 (0-0)	1 (1)	1.0 (0.1-7.1)	1.0 (0.0-25.3)
Hand/Finger/Thumb	0 (0)	0 (0-0)	0 (0)	0 (0-0)	0 (0-0)	0 (0)	0 (0-0)	0 (0-0)
Sternum/Ribs/Upper Back	2 (1)	1.0 (0.3-4.0)	3 (2)	1.0 (0.3-3.1)	1.0 (0.2-7.6)	0 (0)	0 (0-0)	0 (0-0)
Abdomen	3 (2)	1.0 (0.3-3.1)	5 (3)	1.7 (0.7-4.0)	1.7 (0.4-8.1)	5 (3)	1.0 (0.4-2.4)	1.0 (0.2-4.9)
Lower Back/Pelvis/Sacrum	12 (7)	1.3 (0.8-2.3)	6 (4)	1.0 (0.4-2.2)	0.8 (0.3-1.9)	17 (9)	1.4 (0.9-2.3)	1.1 (0.5-2.3)
Hip/Groin	27 (16)	1.7 (1.2-2.5)	27 (18)	1.8 (1.2-2.6)	1.1 (0.6-1.8)	27 (15)	1.9 (1.3-2.8)	1.2 (0.7-2.0)
Thigh	37 (23)	1.9 (1.4-2.7)	40 (26)	1.9 (1.4-2.6)	1.0 (0.6-1.5)	43 (24)	2.4 (1.8-3.2)	1.2 (0.8-1.9)
Hamstrings	20 (54)	1.7 (1.1-2.6)	26 (65)	1.4 (1.0-2.1)	0.9 (0.5-1.6)	26 (60)	1.7 (1.2-2.5)	1.0 (0.6-1.9)
Quadriceps/Lateral Thigh	17 (46)	1.3 (0.8-2.1)	14 (35)	1.2 (0.7-2.0)	0.9 (0.4-1.8)	17 (40)	1.2 (0.8-2.0)	0.9 (0.5-1.8)
Knee	25 (15)	1.7 (1.1-2.5)	25 (16)	1.7 (1.1-2.5)	1.0 (0.6-1.7)	27 (15)	1.5 (1.0-2.2)	0.9 (0.5-1.6)
ACL	3 (14)	1.0 (0.3-3.1)	5 (25)	1.3 (0.5-3.0)	1.3 (0.3-6.1)	6 (29)	1.0 (0.4-2.2)	1.0 (0.3-4.7)
Lower Leg/ Achilles Tendon	20 (12)	1.3 (0.8-1.9)	17 (11)	1.4 (0.9-2.3)	1.1 (0.6-2.2)	22 (12)	1.3 (0.9-2.0)	1.0 (0.6-1.9)
Ankle	17 (10)	1.2 (0.8-2.0)	16 (11)	1.3 (0.8-2.2)	1.1 (0.5-2.2)	24 (13)	1.7 (1.1-2.6)	1.4 (0.8-2.7)
Foot/Toe	12 (7)	1.1 (0.6-1.9)	2 (1)	1.0 (0.3-4.0)	0.9 (0.1-3.4)	4 (2)	1.0 (0.4-2.7)	0.9 (0.3-2.6)

	2015/16			2016/17			2017/18		
Location	n (%)	Injury Rate (95%CI)	RR	n (%)	Injury Rate (95%CI)	RR	n (%)	Injury Rate (95%CI)	RR
Head/Face	5 (4)	1.0 (0.4-2.4)	1.0 (0.3-3.6)	6 (4)	1.0 (0.4-2.2)	1.0 (0.3-3.5)	5 (3)	1.0 (0.4-2.4)	1.0 (0.3-3.6)
Concussion	2 (20)	1.0 (0.3-4.0)	1.0 (0.1-6.0)	3 (75)	1.0 (0.3-3.1)	1.0 (0.2-5.4)	5 (50)	1.0 (0.4-2.4)	1.0 (0.2-4.9)
Neck/Cervical Spine	0 (0)	0 (0-0)	0 (0-0)	0 (0)	0 (0-0)	0 (0-0)	1 (1)	1.0 (0.1-7.1)	0 (0-0)
Shoulder/Clavicle	1 (1)	1.0 (0.1-7.1)	1.0 (0.1-7.8)	5 (3)	1.0 (0.4-2.4)	1.0 (0.2-4.9)	2 (1)	1.0 (0.3-4.0)	1.0 (0.1-6.0)
Elbow	0 (0)	0 (0-0)	0 (0-0)	0 (0)	0 (0-0)	0 (0-0)	0 (0)	0 (0-0)	0 (0-0)
Forearm	1 (1)	1.0 (0.1-7.1)	0.0 (0.0-0.0)	1 (1)	1.0 (0.1-7.1)	1.0 (0.0-25.3)	0 (0)	0 (0-0)	0 (0-0)
Wrist	0 (0)	0 (0-0)	0.0 (0.0-0.0)	0 (0)	0 (0-0)	0 (0-0)	0 (0)	0 (0-0)	0 (0-0)
Hand/Finger/Thumb	1 (1)	1.0 (0.1-7.1)	1.0 (0.1-4.4)	1 (1)	1.0 (0.1-7.1)	1.0 (0.0-25.3)	1 (1)	1.0 (0.1-7.1)	1.0 (0.0-25.3)
Sternum/Ribs/Upper Back	1 (1)	1.0 (0.1-7.1)	1.0 (0.0-10.4)	1 (1)	1.0 (0.1-7.1)	1.0 (0.0-10.4)	2 (1)	1.0 (0.3-4.0)	1.0 (0.1-8.3)
Abdomen	2 (2)	1.0 (0.3-4.0)	1.0 (0.1-6.0)	0 (0)	0 (0-0)	0 (0-0)	0 (0)	0 (0-0)	0.0 (0.0-0.0)
Lower Back/Pelvis/Sacrum	6 (5)	1.2 (0.5-2.7)	0.9 (0.3-2.3)	13 (9)	1.6 (0.9-2.8)	1.2 (0.6-2.7)	6 (4)	1.0 (0.4-2.2)	0.8 (0.3-1.9)
Hip/Groin	10 (8)	1.3 (0.7-2.3)	0.7 (0.3-1.5)	13 (9)	1.2 (0.7-2.0)	0.6 (0.3-1.2)	22 (15)	1.4 (0.9-2.1)	0.8 (0.5-1.4)
Thigh	44 (36)	2.4 (1.8-3.3)	1.3 (0.8-1.9)	43 (29)	2.1 (1.6-2.8)	1.1 (0.7-1.7)	43 (28)	2.1 (1.6-2.9)	1.1 (0.7-1.7)
Hamstrings	27 (61)	1.8 (1.2-2.6)	1.1 (0.6-1.9)	23 (53)	1.4 (0.9-2.0)	0.8 (0.4-1.5)	28 (65)	1.8 (1.2-2.5)	1.1 (0.6-1.9)
Quadriceps/Lateral Thigh	17 (39)	1.4 (0.9-2.3)	1.1 (0.5-2.1)	20 (47)	1.3 (0.9-2.1)	1.0 (0.5-2.0)	15 (35)	1.7 (1.0-2.8)	1.3 (0.6-2.6)
Knee	19 (16)	1.3 (0.8-2.0)	0.9 (0.41-1.4)	23 (16)	1.4 (1.0-2.2)	0.9 (0.5-1.5)	23 (15)	1.4 (0.9-2.0)	0.8 (0.4-1.4)
ACL	3 (19)	1.0 (0.3-3.1)	1.0 (0.2-5.4)	4 (21)	1.0 (0.4-2.7)	1.0 (0.2-5.1)	4 (21)	1.0 (0.4-2.7)	1.0 (0.2-5.1)
Lower Leg/ Achilles Tendon	16 (13)	1.5 (0.9-2.4)	1.2 (0.6-2.2)	14 (10)	1.1 (0.6-1.8)	0.9 (0.4-1.7)	24 (16)	1.7 (1.1-2.6)	1.4 (0.8-2.5)
Ankle	12 (10)	1.1 (0.6-1.9)	0.9 (0.4-1.9)	22 (15)	1.6 (1.0-2.4)	1.3 (0.7-2.5)	9 (6)	1.1 (0.6-2.2)	0.9 (0.4-2.5)
Foot/Toe	3 (2)	1.0 (0.3-3.1)	0.9 (0.2-2.9)	4 (3)	1.0 (0.4-2.7)	0.9 (0.3-2.6)	13 (9)	1.3 (0.8-2.2)	1.2 (0.5-2.6)

**Reference Group*

ACL = Anterior Cruciate Ligament

15 Table 2. Injury count (n), percentage distribution (%), injury rate (95%CI) and rate ratio (RR) by type per season.

	2012/13*		2013/14			2014/15		
Location	n (%)	Injury Rate (95%CI)	n (%)	Injury Rate (95%CI)	RR	n (%)	Injury Rate (95%CI)	RR
Muscle/Tendon	82 (50)	3.2 (2.5-3.9)	84 (55)	3.2 (2.6-4.0)	1.0(0.8-1.4)	96 (53)	4.0 (3.3-4.9)	1.3 (0.9-1.7)
Joint/Ligament	53 (32)	2.3 (1.8-3.0)	41 (27)	1.9 (1.4-2.5)	0.8 (0.5-1.2)	52 (29)	2.4 (1.8-3.1)	1.0 (0.7-1.5)
Fracture/Bone Stress	9 (5)	1.5 (0.8-2.9)	7 (5)	1.4 (0.7-2.9)	0.9 (0.3-2.5)	12 (7)	1.3 (0.8-2.3)	0.9 (0.4-2.2)
Contusions, Laceration and Skin Lesion	10 (6)	1.1 (0.6-2.1)	8 (5)	1.3 (0.7-2.7)	1.2 (0.5-3.0)	3 (2)	1.0 (0.3-3.1)	0.9 (0.2-2.9)
Central/Peripheral Nervous System	8 (5)	1.0 (0.5-2.0)	7 (5)	1.2 (0.6-2.4)	1.2 (0.4-3.2)	14 (8)	1.1 (0.6-1.8)	1.1 (0.5-2.7)
Other	2 (1)	1.0 (0.3-4.0)	5 (3)	1.3 (0.5-3.0)	1.3 (0.3-8.7)	5 (3)	1.0 (0.4-2.4)	0.8 (0.2-7.0)

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	2015/16			2016/17			2017/18		
Location	n (%)	Injury Rate (95%CI)	RR	n (%)	Injury Rate (95%CI)	RR	n (%)	Injury Rate (95%CI)	RR
Muscle/Tendon	67 (55)	2.9 (2.3-3.7)	0.9 (0.7-1.3)	77 (53)	3.0 (2.4-3.7)	0.9 (0.7-1.3)	90 (60)	3.6 (2.9-4.4)	1.1 (0.8-1.5)
Joint/Ligament	26 (21)	1.5 (1.0-2.2)	0.7 (0.4-1.1)	49 (34)	2.5 (1.9-3.2)	1.1 (0.7-1.6)	31 (21)	1.7 (1.2-2.4)	0.7 (0.5-1.2)
Fracture/Bone Stress	5 (4)	1.0 (0.4-2.4)	0.7 (0.2-1.9)	9 (6)	1.1 (0.6-2.2)	0.8 (0.3-1.9)	15 (10)	1.7 (1.0-2.8)	1.1 (0.5-2.6)
Contusions, Laceration and Skin Lesion	10 (8)	1.4 (0.8-2.7)	1.2 (0.5-3.1)	3 (2)	1.0 (0.3-3.1)	0.9 (0.2-3.0)	0 (0)	0 (0-0)	0 (0-0)
Central/Peripheral Nervous System	10 (8)	1.3 (0.7-2.3)	1.3 (0.5-3.3)	4 (3)	1.0 (0.4-2.7)	1.0 (0.3-3.2)	10 (7)	1.4 (0.8-2.5)	1.4 (0.6-3.7)
Other	3 (2)	1.0 (0.3-3.1)	1.0 (0.2-7.6)	4 (3)	1.3 (0.5-3.6)	1.3 (0.3-9.6)	5 (3)	1.0 (0.4-2.4)	1.0 (0.2-7.0)

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