

AFL Injury Report 2002

Dr John Orchard, Dr Hugh Seward, AFLMOA

Highlights:

- Presents findings from the eleventh consecutive year of injury surveillance for the AFL, the last six years with 100% compliance.
- Documents a *slight decrease* in missed playing time through injury for season 2002 compared to season 2001 and shows that historically season 2002 was *slightly below* average with respect to time missed through injury. In terms of overall numbers of injuries that caused games to be missed, season 2002 had a *lower* injury incidence than *any* of the previous 11 years.
- Shows a continuing trend for teams to be more conservative in their management of injury, with both an increasing injury severity rate (missed games per injury) and a decreasing recurrence rate.
- For the first time, hamstring injuries, which reduced in incidence and prevalence during season 2002, caused less missed playing time than both knee ACL injuries and groin injuries, which both increased in prevalence. Hamstring injuries were still the most frequent injury.
- Overall injury rate and some specific lower limb injuries such as knee ACLs and groin injuries, show a high correlation with weather conditions. Knee ACL and groin injuries were high in seasons 2001 and 2002, which were dry and hot 'El Nino' years. The highest recorded peak for ACL and groin injuries was during the previous 'El Nino' year in 1997.
- Penetrometer readings show very little correlation with injury incidence. The ground variable apparently responsible for most variation in injury incidence is shoe-surface traction, rather than hardness. Although shoe-surface traction is difficult to measure, it is known to be greater for couch grass than rye grass. All AFL venues now predominantly use rye grass for the majority of the season and this change has probably contributed to injury reduction in recent seasons.
- The injury report continues to provide a focus for the AFL Research & Development Board, with major projects funded in recent years by the AFL R&D Board for the injury types shown by the injury survey to be of greatest prevalence and severity.



Table of contents:

Highlights:..... 1
INTRODUCTION..... 3
METHODS..... 3
RESULTS..... 4
DISCUSSION 9
 Knee Anterior Cruciate Ligament (ACL) injuries..... 9
 Groin injuries and osteitis pubis..... 9
 Hamstring strains..... 9
 Conclusion..... 11
Acknowledgments: 11
Appendix – Detailed tables 12
REFERENCES 19

INTRODUCTION

The eleventh season of the AFL Injury Survey was completed in 2002. The initial survey year (1992) included Australian football, rugby league and rugby union injuries¹ and the AFL has sponsored surveillance of its own competition ever since. The public release of the annual report makes the AFL injury survey one of the world's leading sporting injury studies of this kind². The AFL now funds research studies to the value of approximately \$200,000 per annum. The injury survey has a critical position in directing this funding appropriately to studying injuries that are common and/or severe in AFL players. Since 1997, the injury survey has accounted for every case of senior listed players missing games through injury in the home & away season². In 2001 this was extended to include rookie listed players and finals matches.

METHODS

The methods of the injury survey are now well established and have been previously described in detail². Player movement monitoring essentially requires that all clubs define the status of each player each round to be either: (1) playing AFL football (2) playing football at a lower level (3) not playing football due to injury or (4) not playing football for another reason.

The definition of an injury is “any medical condition that prevents a player from participating in a regular season (home and away) or finals match”. The major measurement of the number of injuries occurring is *seasonal injury incidence* measured in a unit of *new injuries per club per season* (where a club is defined as 40 players and a season is defined as 22 rounds). The major measurement of the amount of playing time missed through injury is *injury prevalence* measured in a unit of *missed games per club per season*, or alternatively *percentage of players unavailable through injury*. The recurrence rate is the number of recurrent injuries expressed as a percentage of the number of new injuries. A recurrent injury was an injury in the same injury category occurring on the same side of the body in a player during the same season. Therefore, by this definition, an injury of one type that recurred the following season was defined as a new injury in that next season.

RESULTS

Table 1 details player status on a weekly basis over the past six seasons, when full compliance with the injury survey has been achieved. The ‘average’ status of a club list of 42 players in any given week over the last 6 years was: 34 players playing football per week, 7 missing through injury and 2 missing through other reasons (such as suspension, being used as a travelling emergency, team bye in lower grade etc.).

Status	1997	1998	1999	2000	2001	2002	Aver.
Playing AFL	21.0	22.0	22.0	22.0	22.0	22.0	21.8
Playing lower grade football	11.8	11.4	11.4	11.3	12.9	12.1	11.8
<i>TOTAL playing</i>	32.8	33.4	33.4	33.3	34.9	34.1	33.6
Not playing because of injury	7.7	6.7	6.4	6.2	6.7	6.6	6.7
Not playing for other reasons	1.5	1.2	1.6	1.6	1.5	2.1	1.6
<i>TOTAL not playing</i>	9.1	7.9	8.0	7.8	8.2	8.7	8.3
<i>Players in injury survey (per club)</i>	41.9	41.3	41.4	41.1	43.1	42.7	41.9
<i>Injury prevalence (%)</i>	18.3%	16.3%	15.5%	15.1%	15.6%	15.4%	16.0%

Table 1 - Average weekly player status by season

Table 2 details the incidence of some of the most notable types of injuries. Hamstring strains have been the most common injury in every year of the survey, with generally 6 of these injuries occurring per club per season. The incidence of 4.5 hamstring injuries per team per season in 2002 was the lowest ever recorded for the survey (see also Figure 2). Knee Posterior Cruciate Ligament (PCL) injuries decreased in 2002, whereas Anterior Cruciate Ligament (ACL) and groin injuries increased. Groin strains are grouped together with osteitis pubis cases, due to the high amount of overlap between these two conditions. In the appendix, Table 10 lists the injury incidence for all injury categories.

Injury type	1997	1998	1999	2000	2001	2002	Av.
Groin strains and osteitis pubis	4.1	3.3	3.1	3.0	3.5	3.9	3.5
Hamstring strains	6.8	6.4	6.8	5.8	6.1	4.5	6.1
Quadriceps strains	2.5	3.0	2.4	2.0	1.6	1.7	2.2
Knee ACL	1.2	0.8	0.7	0.5	0.9	0.8	0.8
Knee MCL	0.7	1.3	1.2	0.9	1.2	0.9	1.0
Knee PCL	0.6	0.3	0.7	0.5	1.0	0.4	0.6
Calf strains	1.9	2.3	1.4	1.9	1.6	2.2	1.9
Ankle sprains or joint injuries	2.7	2.8	2.1	2.7	2.0	2.5	2.5
TOTAL INJURIES PER CLUB	41.9	40.3	36.9	37.4	35.9	34.2	37.8

Table 2 - Injury incidence (new injuries per club per season) for selected categories

Table 3 shows the high rate of recurrence of the most common injury types (particularly muscle strains) which lead to a high overall recurrence rate for injuries in the AFL as a whole. Some other injuries, such as fractures, concussion and ‘cork’ injuries have a low recurrence rate. The issue of recurrence for muscle strains is the subject of ongoing research³.

Injury type	1997	1998	1999	2000	2001	2002	Aver.
Hamstring strains	37%	36%	30%	39%	25%	30%	33%
Groin strains and osteitis pubis	36%	31%	6%	16%	20%	23%	22%
Ankle sprains or joint injuries	20%	21%	9%	11%	17%	16%	15%
Quadriceps strains	35%	20%	20%	18%	10%	17%	20%
Calf strains	15%	15%	17%	32%	17%	13%	18%
ALL INJURIES	20%	19%	14%	16%	15%	13%	16%

Table 3 - Recurrence rates (recurrent injuries as a percentage of new injuries)

Table 4 details the amount of missed playing time attributed to the most notable injury categories. In season 2002, hamstring strains were surpassed by both groin injuries and knee ACL injuries in terms of missed playing time. Only in one other previous season of the injury survey (1996) have hamstring strains not been the number one injury in terms of missed playing time. The full comparison of injury prevalence can be seen in the appendix in Table 11. From Table 11, it can be seen that there was an increase in missed playing time due to concussion in season 2002. However, this was virtually due to a single player who missed the entire season with football-related migraines. The incidence of concussion in 2002 remained very low (0.7 cases per team per season) and was almost exactly at the long-term average.

Injury type	1997	1998	1999	2000	2001	2002	Aver
Shoulder sprains and dislocations	5.3	5.9	5.6	4.0	5.4	5.9	4.7
Groin strains and osteitis pubis	17.4	13.9	9.4	7.5	13.6	15.8	12.9
Hamstring strains	21.0	21.0	22.6	22.9	21.4	15.7	20.8
Quadriceps strains	8.6	9.5	6.7	5.6	3.8	4.3	6.4
Knee ACL	19.8	15.8	10.8	4.8	13.6	16.5	13.6
Knee MCL	3.3	4.3	3.3	3.5	4.8	3.3	3.8
Knee PCL	1.9	2.2	5.2	2.3	5.9	2.3	3.3
Knee cartilage	4.0	5.6	5.3	8.6	12.5	6.0	7.0
Ankle sprains or joint injuries	7.2	6.9	3.9	6.8	4.3	5.9	5.8
Leg and foot fractures	2.6	5.4	8.8	4.6	7.2	7.9	6.1
MISSED GAMES PER CLUB	159.2	141.9	135.9	131.8	136.4	134.7	140.0

Table 4 - Injury prevalence (missed games per club per season) for selected categories

Average injury severity for the major injury categories is shown in Table 5. Most injuries show consistent injury severity from season to season, whereas ACL injuries vary considerably, depending on whether most of these injuries, in a given year, occur at the start of, or later in, the season. ACL injuries will generally cause a player to miss the entire season after having a knee reconstruction, although there are occasional exceptions to this rule. Injury severity for all injuries is detailed in Table 12.

Injury type	1997	1998	1999	2000	2001	2002	Av.
Shoulder sprains and dislocations	5.3	6.5	8.5	5.6	4.9	6.7	6.3
Groin strains and osteitis pubis	4.3	4.2	3.0	2.5	3.9	4.1	3.7
Hamstring strains	3.1	3.3	3.3	3.9	3.5	3.5	3.4
Quadriceps strains	3.4	3.2	2.8	2.8	2.3	2.6	2.8
Knee ACL	16.8	18.8	16.4	9.9	14.6	19.9	16.1
Knee MCL	4.7	3.4	2.8	3.9	4.0	3.5	3.7
Knee PCL	3.3	7.4	7.2	4.8	5.9	5.9	5.7
Knee cartilage	4.3	4.9	4.6	7.1	6.5	5.0	5.4
Ankle sprains or joint injuries	2.7	2.4	1.9	2.5	2.2	2.4	2.3
Leg and foot fractures	4.9	6.9	7.7	7.6	6.9	9.5	7.3
ALL INJURIES	3.8	3.5	3.7	3.5	3.8	4.0	3.7

Table 5 - Injury severity (matches missed per new injury)

Table 6 details injury prevalence by player age for seasons 1992-2002 inclusive. Hamstring strains, calf strains, lumbar spine and knee cartilage injuries are much more prevalent in older players, making the overall burden of injury much greater in players aged 24 and over compared to those 23 and younger (all $P < 0.05$). There are certain injuries that follow a reverse pattern, particularly stress fractures, which are more prevalent in younger players ($P < 0.05$). Groin strains and osteitis pubis are slightly more common in younger players, although this difference does not reach statistical significance. A full comparison of player age and injury prevalence is shown in Table 13.

Age group	Injury category	<21	21-23	24-26	27-29	30+
Injuries affecting more younger players	A/C joint injuries	2.6	2.2	1.9	1.5	1.2
	Fractured clavicles	1.8	1.3	1.2	1.5	0.8
	Groin strains and osteitis pubis	12.0	10.8	12.9	8.8	10.3
	Leg and foot stress fractures	6.9	6.3	3.6	1.9	0.0
Injuries affecting more older players	Rib and chest wall injuries	1.4	1.5	1.9	1.8	2.7
	Lumbar and thoracic spine injuries	4.5	4.0	7.2	11.5	13.3
	Hamstring strains	15.0	17.8	24.6	27.3	32.3
	Knee cartilage	5.6	3.4	10.1	13.6	8.6
	Calf strains	1.8	2.2	6.5	10.1	12.0
	Achilles tendon injuries	0.5	0.5	2.7	2.2	5.5
TOTAL MISSED GAMES		115.3	127.2	151.6	157.2	169.1

Table 6 - Injury prevalence by player age

Over the past 5 seasons, the major AFL venues have recorded Penetrometer readings prior to games to assess the risk of injury and its relationship to ground hardness. The most accurate and valuable measurement has been the first drop reading of the Penetrometer⁴. This study was undertaken in response to the finding that the overall injury prevalence was consistently higher in the teams based in northern states

compared to teams based in Victoria⁵. It was hypothesized that perhaps grounds are generally harder in the northern venues, which might lead to greater injury rates. The relationship of injury risk to Penetrometer readings is not strong (Tables 7 and 14). The only injury categories showing a statistically significant relationship between hardness and injury risk are A/C joint sprains (which are more likely on harder grounds) and facial fractures (which are more likely on softer grounds). It can be explained that as A/C joint sprains often occur due to impact with the ground that hardness would be a risk factor, but it is harder to explain why facial fractures would be more common on softer grounds. Perhaps on softer grounds there is more accidental head-high contact because players are less sure of their footing. Factors other than ground hardness are almost certainly involved in the relationship between ground conditions and injury, including grass type, grass density, player boot selection, water evaporation and rainfall⁴⁻⁷ and also speed of the game^{8,9}. Because of the apparent connection between increased traction and injury risk, and the likelihood that couch grass grounds lead to higher traction than rye grass, all AFL grounds have moved over the last few seasons to make rye grass their most predominant grass type.

Injury category	Harder (2.5 or less)	Medium (2.6-3.0)	Softer (3.1 or greater)	Comparison
Concussion	0.8	0.6	0.6	^
Facial fractures	0.4	0.3	1.1	#(p<0.05)
A/C joint injuries	1.1	0.5	0.5	*(p<0.05)
Hamstring strains	5.1	4.5	3.4	^
Quadriceps strains	0.9	1.2	0.6	^
Knee ACL	0.8	0.6	0.5	^
Knee MCL	0.8	0.9	1.2	^
Knee PCL	1.0	0.5	0.6	^
Ankle sprains or joint injuries	1.8	2.1	2.2	^
Calf strains	1.4	1.0	1.0	^
ALL INJURIES	26.4	24.6	22.3	^

*Significantly more injuries on harder grounds

#Significantly more injuries on softer grounds

^No significant difference between hard and soft grounds

Table 7 – Injury match incidence (injuries per 1000 player hours) by first drop of Penetrometer

Figure 1 shows the variation of injury incidence and prevalence over the past 11 years, which reveals that season 2002 was slightly below the 11 year average. Figure 2 plots the prevalence of the ‘big 3’ injuries (hamstring injuries, groin injuries and ACL injuries) along with Melbourne rainfall. The rainfall is measured as an annual figure with a year commencing in October and finishing in September, but is plotted inversely in Figure 2 (dry years near the top of the graph, wet years near the bottom). There is seasonal variation in Melbourne rainfall and this correlates inversely with the prevalence of groin injuries ($r=-0.723$) and ACL injuries ($r=-0.383$). There is also an even higher positive correlation between seasonal prevalence of groin injuries and ACL injuries ($r=0.814$), showing that in years with high rates of ACL injuries, the groin injury rates are also high. This suggests that similar weather and ground variables may be responsible for both of these injury types. By comparison, hamstring strains show a fairly steady injury prevalence over the decade with little relationship to seasonal rainfall ($r=-.171$).

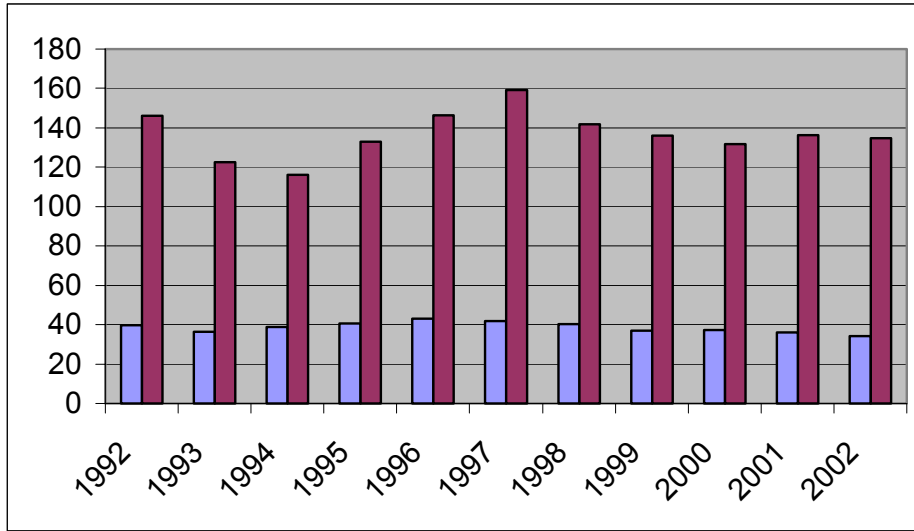


Figure 1 - Injury incidence and prevalence by season



Figure 2- Prevalence of major injury categories compared to Melbourne annual rainfall (mm Oct-Sept)

DISCUSSION

Knee Anterior Cruciate Ligament (ACL) injuries

The injury prevalence rates over the past decade show upwards and downwards trends in ACL injury rates from year-to-year. In seasons where there has been higher rainfall in the preceding 12 months in Melbourne, the rates of knee ACL injuries have been lower⁷, as shown in figure 2. The seasons in which there are higher rates of knee ACL injuries (Figure 2) tend to be seasons with low rainfall, and high rates of groin injuries and injuries overall. Although this observation suggests that softer grounds may be the mechanism by which injury rates vary, the results of the Penetrometer study to date do not show a strong correlation between ground hardness and injury. It is likely that grass cover and traction play a more important role⁶. Perhaps in seasons where there is less rainfall, the grass root density is thicker, and players can gain more traction. These theories need to be further tested over coming years.

Although it is likely that there is a significant relationship between ground conditions and ACL injuries that we do not fully understand to date, a much stronger relationship is well established between individual injury history and ACL injury risk¹⁰. Unfortunately, players who are returning from ACL injury have a 10-times greater risk of recurrence in the immediate months after their return, and have a lifetime 4-times greater risk of both re-injury of the same knee ACL and also of the opposite knee ACL¹⁰.

Groin injuries and osteitis pubis

Osteitis pubis has been the focus of intense media interest over the past 2 seasons. Some of the increased focus has been due to the greater role of the medical media commentator, although the latest injury report figures show an increase in groin injuries over the past 2 seasons (Tables 2&4 and Figure 2). There has also been concern at the apparently high prevalence of injury amongst very young players of osteitis pubis, and the AFL injury surveillance data supports the theory that this is a prevalent injury in young players. This injury may stand out more in younger players because across the board, the injury prevalence for younger players is generally much lower than for older players (Table 6).

Hamstring strains

Hamstring strains remain the most common injury in the AFL, although in 2002 the prevalence of hamstring injuries was the lowest on record. Previous analysis of hamstring and other muscle strain data shows a high rate of recurrence^{3 11-13}. The current AFL data shows that management of these injuries has become more conservative over the last decade in the AFL. The amount of time that players miss per injury (severity) has increased over the last ten years, whereas the recurrence rate has decreased (Figure 3). A trade-off between early return and risk of recurrence has been described³.

The data presented in this report (Table 6) confirms the findings of previous studies that hamstring muscle strains, along with calf muscle strains, are both far more common in older players^{11 13}. It is thought that there is a relationship between lumbar spine problems, which are also common in older players, and hamstring injuries, but this relationship is still poorly understood.

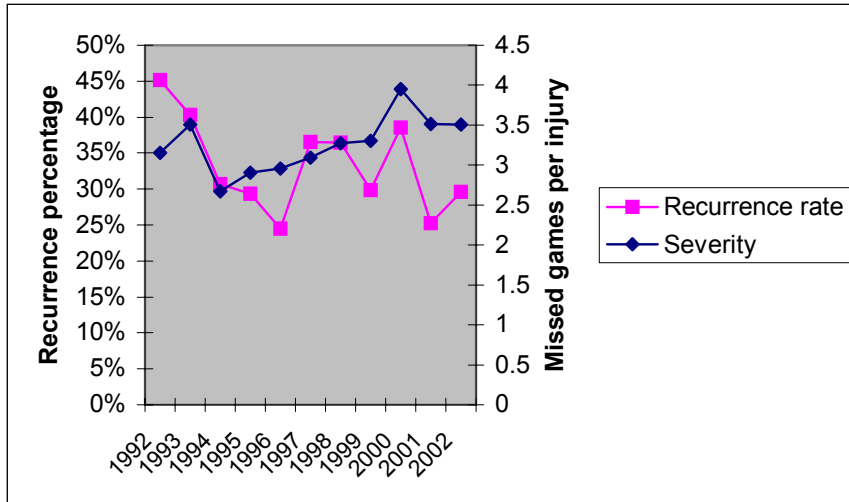


Figure 3 - Hamstring injury severity and rate of recurrence by season

Conclusion

The AFL injury profile continues to be consistently defined and published in both the sports medicine scientific literature² and in public media releases. Hamstring injuries, knee ACL injuries and groin injuries (including osteitis pubis) are the most prevalent injuries in AFL players. In season 2002, hamstring injuries fell to their lowest rates on record. All injuries and in particular hamstring injuries are being treated more conservatively in recent years by AFL teams. Groin injuries and ACL injuries increased in prevalence in season 2002, and part of this increase can be explained by dry weather conditions in 2002, although the mechanism by which these variables are connected does *not* appear to be harder grounds. The overall injury prevalence in season 2002 was lower than AFL injury survey averages and slightly less than 2001.

The AFL has directed substantial additional funding towards the injuries of greatest prevalence in the game. The speed of the game and size of the players is probably slowly increasing and potentially driving the injury rates in the AFL higher. However, improvements in sports medicine and science, including those gained from projects directly sponsored by the AFL, are helping to relieve the injury burden on AFL players.

Acknowledgments:

The authors and AFL Medical Officers would like to acknowledge the following people who contributed to the survey in 2002:

Peter Waldie and Dr Brian Sando (trainer and doctor, Adelaide), Victor Popov (physiotherapist, Brisbane), Dr Phil Perlstein (doctor, Carlton), Dr Andrew Jowett (doctor, Collingwood), Bruce Connor (physiotherapist, Essendon), Dr Ken Withers and Norm Tame (doctor and football staff, Fremantle), Dr Jeanne McGivern and Dr Hugh Seward (doctors, Geelong), Chris Ward (physiotherapist, Hawthorn), Dr Andrew Daff (doctor, Melbourne), Dr Con Mitropolous (Kangaroos), Andrew Russell (conditioner, Port Adelaide), Dr Tim Barbour (doctor, Richmond), Dr Ian Stone (doctor, St. Kilda), Matt Cameron (physiotherapist, Sydney), Dr Rod Moore and Bill Sutherland (doctor and trainer, West Coast Eagles), Dr Gary Zimmerman (doctor, Western Bulldogs), Dr Peter Harcourt (AFL Medical Commission), Rod Austin, Jill Lindsay and Andrew Demetriou (AFL administration), all those acknowledged in the injury reports for previous years (particularly Dr Tim Wood who had a major administrative role during the early years of the injury survey) and all AFL Ground managers and ground staff.



Appendix – Detailed tables

Table 10 – Injury incidence (new injuries per club per season)

Body area	Injury type	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Head/neck	Concussion	1.3	0.9	0.8	0.8	0.9	0.6	0.7	0.5	0.6	0.7	0.7
	Facial fractures	0.8	0.6	0.8	0.6	0.6	0.8	0.7	0.8	0.7	0.4	0.4
	Neck sprains	0.3	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.0
	Other head and neck injuries	0.1	0.0	0.1	0.2	0.1	0.2	0.2	0.2	0.1	0.3	0.2
Shoulder/arm/elbow	Shoulder sprains and dislocations	0.9	0.7	0.6	0.6	0.7	1.0	0.9	0.7	0.7	1.1	0.9
	A/C joint injuries	0.9	0.6	1.0	0.9	1.2	0.9	0.9	0.6	1.3	0.9	1.1
	Fractured clavicles	0.2	0.1	0.2	0.1	0.2	0.4	0.4	0.3	0.5	0.3	0.3
	Elbow sprains or joint injuries	0.1	0.1	0.1	0.1	0.4	0.2	0.1	0.1	0.1	0.2	0.1
	Other shoulder/arm/elbow injuries	0.5	0.2	0.5	0.6	0.5	0.6	0.5	0.2	0.5	0.5	0.8
Forearm/wrist/hand	Forearm/wrist/hand fractures	1.0	0.8	1.2	1.5	2.2	1.1	1.7	1.7	1.4	0.8	1.1
	Other forearm/wrist/hand injuries	0.6	0.2	0.6	0.4	0.1	0.4	0.4	0.4	0.7	0.3	0.4
Trunk/back	Rib and chest wall injuries	0.8	0.7	0.5	0.9	0.8	0.8	0.5	0.8	0.6	0.3	0.8
	Lumbar and thoracic spine injuries	1.5	1.5	1.8	2.0	2.0	2.2	1.6	1.6	2.4	1.6	0.9
	Other trunk/back/buttock injuries	1.1	0.1	0.6	0.6	0.6	1.0	0.9	1.0	0.5	0.4	0.4
Hip/groin/thigh	Groin strains and osteitis pubis	2.7	2.0	3.1	3.2	3.6	4.1	3.3	3.1	3.0	3.5	3.9
	Hamstring strains	6.7	5.4	6.3	6.9	6.0	6.8	6.4	6.8	5.8	6.1	4.5
	Quadriceps strains	1.7	1.5	2.1	1.8	2.0	2.5	3.0	2.4	2.0	1.6	1.7
	Thigh and hip haematomas	1.8	0.9	1.0	1.4	1.5	1.3	1.3	1.1	1.1	0.6	1.0
	Other groin/hip/thigh injuries	0.1	0.3	0.2	0.1	0.2	0.4	0.2	0.3	0.4	0.3	0.3
Knee	Knee ACL	1.2	0.7	0.8	0.9	1.2	1.2	0.8	0.7	0.5	0.9	0.8
	Knee MCL	1.1	1.8	1.0	1.2	1.0	0.7	1.3	1.2	0.9	1.2	0.9
	Knee PCL	0.5	0.3	0.5	0.6	0.6	0.6	0.3	0.7	0.5	1.0	0.4
	Knee cartilage	1.4	1.1	1.5	1.8	1.6	0.9	1.1	1.1	1.2	1.9	1.2
	Patella injuries	0.1	0.3	0.3	0.4	0.5	0.2	0.4	0.1	0.2	0.2	0.4
	Knee and patella tendon injuries	0.1	0.4	0.3	0.4	0.4	0.5	0.6	0.7	0.7	0.5	0.7



Body area	Injury type	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Shin/ankle/foot	Other knee injuries	0.8	1.1	0.9	0.8	1.1	1.4	0.4	0.9	1.3	0.8	0.5
	Ankle sprains or joint injuries	2.4	2.3	1.6	2.1	2.7	2.7	2.8	2.1	2.7	2.0	2.5
	Calf strains	1.3	1.6	1.3	1.6	2.0	1.9	2.3	1.4	1.9	1.6	2.2
	Achilles tendon injuries	0.4	0.6	0.6	0.3	0.4	0.4	0.3	0.5	0.4	0.2	0.4
	Leg and foot fractures	0.7	0.5	0.5	1.0	0.6	0.5	0.8	1.1	0.6	1.0	0.8
	Leg and foot stress fractures	0.7	0.9	1.1	0.7	0.6	0.8	0.7	0.8	0.5	0.9	0.7
	Other leg/foot/ankle injuries	0.9	1.4	1.1	2.3	1.2	1.9	1.7	1.3	1.4	1.7	0.9
Medical illness	Medical illnesses	0.9	0.4	0.8	1.1	3.0	2.5	2.8	1.6	1.9	1.8	2.3
	Unaccounted injuries	4.1	6.1	5.1	2.6	2.4	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL INJURIES PER CLUB		39.6	36.4	38.8	40.8	43.1	41.9	40.3	36.9	37.4	35.9	34.2

Table 11 – Injury prevalence (missed games per club per season)

Body category	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	
Head/neck	Concussion	2.0	1.3	0.9	0.8	1.3	0.7	0.7	0.5	0.7	1.3	2.0
	Facial fractures	3.7	1.3	2.7	2.0	1.5	2.5	2.1	2.3	2.0	1.3	1.4
	Neck sprains	0.3	0.1	0.1	0.4	0.2	0.7	0.7	1.6	0.3	0.2	0.0
	Other head and neck injuries	0.1	0.0	0.3	0.7	0.1	0.3	0.2	0.4	0.8	1.5	0.2
Shoulder/arm/elbow	Shoulder sprains and dislocations	5.9	3.9	4.0	2.7	3.1	5.3	5.9	5.6	4.0	5.4	5.9
	A/C joint injuries	2.0	1.7	1.9	2.4	2.8	2.2	2.1	0.9	3.1	2.1	2.4
	Fractured clavicles	1.4	0.8	1.3	1.0	1.1	1.4	1.6	1.2	3.0	1.6	2.0
	Elbow sprains or joint injuries	0.1	0.3	0.9	0.1	1.1	0.7	1.2	0.2	0.1	0.4	0.3
	Other shoulder/arm/elbow injuries	1.3	0.5	1.1	2.1	1.1	2.4	1.9	0.3	1.3	1.3	4.0
Forearm/wrist/hand	Forearm/wrist/hand fractures	3.5	3.2	3.3	6.4	9.8	4.1	5.4	5.9	5.6	2.8	3.1



THE AFL INJURY REPORT

Body category		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	Other forearm/wrist/hand injuries	2.2	0.4	1.1	0.7	0.4	0.7	1.3	0.9	1.8	0.3	2.2
Trunk/back	Rib and chest wall injuries	1.4	1.6	0.8	1.5	0.9	1.7	0.8	1.7	0.9	0.5	1.3
	Lumbar and thoracic spine injuries	5.6	5.4	3.0	6.4	7.1	13.0	4.7	8.0	8.6	5.9	5.8
	Other trunk/back/buttock injuries	2.0	0.2	0.8	1.6	0.8	3.7	1.4	2.0	2.2	1.5	1.7
Hip/groin/thigh	Groin strains and osteitis pubis	11.5	8.2	10.3	10.1	10.8	17.4	13.9	9.4	7.5	13.6	15.8
	Hamstring strains	21.2	19.0	16.9	20.0	17.9	21.0	21.0	22.6	22.9	21.4	15.7
	Quadriceps strains	7.1	4.5	6.1	4.5	6.9	8.6	9.5	6.7	5.6	3.8	4.3
	Thigh and hip haematomas	2.4	1.4	1.1	2.2	2.5	2.4	1.8	1.5	1.8	0.6	1.9
	Other groin/hip/thigh injuries	0.1	1.3	0.7	0.1	0.8	1.7	0.5	2.3	1.5	1.7	1.2
Knee	Knee ACL	15.2	5.5	10.1	14.3	17.9	19.8	15.8	10.8	4.8	13.6	16.5
	Knee MCL	3.6	6.1	4.7	2.9	4.0	3.3	4.3	3.3	3.5	4.8	3.3
	Knee PCL	3.5	2.4	3.4	2.0	3.3	1.9	2.2	5.2	2.3	5.9	2.3
	Knee cartilage	9.1	4.6	5.9	7.6	6.8	4.0	5.6	5.3	8.6	12.5	6.0
	Patella injuries	1.1	1.3	1.3	1.1	4.3	0.9	1.6	0.8	1.8	0.8	2.5
	Knee and patella tendon injuries	0.1	0.6	1.1	1.6	3.1	2.4	1.6	3.9	3.9	2.5	3.7
	Other knee injuries	2.9	3.5	2.4	1.6	2.3	3.9	1.2	2.2	3.6	2.5	1.0
	Other knee injuries	2.9	3.5	2.4	1.6	2.3	3.9	1.2	2.2	3.6	2.5	1.0
Shin/ankle/foot	Ankle sprains or joint injuries	6.5	6.1	4.3	6.1	7.3	7.2	6.9	3.9	6.8	4.3	5.9
	Calf strains	3.5	4.3	2.4	4.4	4.6	5.8	6.4	3.4	5.7	3.4	4.4
	Achilles tendon injuries	0.9	3.5	2.0	0.3	1.5	1.3	1.4	1.3	1.6	0.7	0.9
	Leg and foot fractures	4.3	4.6	3.6	8.8	6.0	2.6	5.4	8.8	4.6	7.2	7.9
	Leg and foot stress fractures	7.2	7.5	6.0	3.0	4.2	4.9	4.0	6.7	3.8	4.4	3.9
	Other leg/foot/ankle injuries	2.2	3.9	2.3	4.8	2.6	6.4	5.1	3.1	4.1	4.2	2.3
Medical illness	Medical illnesses	2.2	0.9	1.5	4.4	5.3	4.2	3.7	3.3	2.8	2.6	2.9
	Unaccounted missed games	9.9	12.6	7.8	4.4	2.8	0.0	0.0	0.0	0.0	0.0	0.0
	MISSED GAMES PER CLUB	146.0	122.5	116.3	133.1	146.4	159.2	141.9	135.9	131.8	136.4	134.7



Table 12 – Injury severity (missed games per new injury)

Body area	Injury category	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Head/neck	Concussion	1.6	1.4	1.1	1.0	1.4	1.1	1.0	1.1	1.1	1.8	3.1
	Facial fractures	4.6	2.0	3.3	3.2	2.5	3.0	3.2	2.9	2.8	3.3	3.6
	Neck sprains	1.0	1.0	2.0	3.0	2.0	6.0	3.7	8.7	1.7	1.5	0.0
	Other head and neck injuries	1.0	0.0	4.0	3.7	1.0	1.3	1.3	2.0	7.0	5.4	1.3
Shoulder/arm/elbow	Shoulder sprains and dislocations	6.8	5.5	7.1	4.8	4.4	5.3	6.5	8.5	5.6	4.9	6.7
	A/C joint injuries	2.3	2.7	1.9	2.5	2.3	2.3	2.3	1.5	2.5	2.3	2.2
	Fractured clavicles	6.3	6.0	6.7	8.0	4.5	3.8	3.9	4.0	6.3	6.0	6.2
	Elbow sprains or joint injuries	1.0	2.0	15.0	1.0	3.0	3.0	10.0	2.0	2.0	1.8	5.0
	Other shoulder/arm/elbow injuries	2.6	2.3	2.1	3.4	2.4	3.7	3.4	1.7	2.3	2.6	4.8
Forearm/wrist/hand	Forearm/wrist/hand fractures	3.5	3.8	2.8	4.4	4.5	3.8	3.1	3.5	4.0	3.4	2.9
	Other forearm/wrist/hand injuries	3.9	1.7	2.0	1.6	3.5	1.7	3.5	2.5	2.7	1.0	5.6
Trunk/back	Rib and chest wall injuries	1.7	2.3	1.5	1.7	1.2	2.2	1.8	2.2	1.5	1.5	1.5
	Lumbar and thoracic spine injuries	3.7	3.6	1.7	3.2	3.5	5.9	2.9	5.2	3.6	3.6	6.1
	Other trunk/back/buttock injuries	1.8	1.5	1.3	2.5	1.4	3.6	1.6	2.1	4.0	3.9	3.9
Hip/groin/thigh	Groin strains and osteitis pubis	4.2	4.1	3.3	3.1	3.0	4.3	4.2	3.0	2.5	3.9	4.1
	Hamstring strains	3.2	3.5	2.7	2.9	3.0	3.1	3.3	3.3	3.9	3.5	3.5
	Quadriceps strains	4.3	3.0	2.9	2.4	3.4	3.4	3.2	2.8	2.8	2.3	2.6
	Thigh and hip haematomas	1.3	1.5	1.1	1.6	1.7	1.8	1.4	1.3	1.6	1.0	1.9
	Other groin/hip/thigh injuries	1.0	4.5	3.7	1.0	4.3	4.0	3.0	7.6	4.2	6.2	4.2
Knee	Knee ACL	12.4	7.8	12.4	15.1	14.4	16.8	18.8	16.4	9.9	14.6	19.9
	Knee MCL	3.3	3.3	4.7	2.4	4.0	4.7	3.4	2.8	3.9	4.0	3.5
	Knee PCL	7.0	8.5	6.8	3.6	5.5	3.3	7.4	7.2	4.8	5.9	5.9



THE AFL INJURY REPORT

Body area	Injury category	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	Knee cartilage	6.6	4.1	3.9	4.3	4.3	4.3	4.9	4.6	7.1	6.5	5.0
	Patella instability	7.5	4.8	5.3	3.0	9.1	4.0	4.3	7.0	10.0	5.0	6.6
	Knee and patella tendon injuries	1.0	1.5	3.6	3.6	7.4	4.4	2.6	5.9	5.4	5.1	5.1
	Other knee injuries	3.6	3.3	2.8	2.0	2.1	2.9	2.9	2.4	2.7	3.2	2.0
Shin/ankle/foot	Ankle sprains or joint injuries	2.7	2.7	2.6	2.8	2.7	2.7	2.4	1.9	2.5	2.2	2.4
	Calf strains	2.7	2.7	1.9	2.8	2.3	3.0	2.7	2.4	3.1	2.1	2.1
	Achilles tendon injuries	2.6	6.1	3.2	1.3	4.3	3.7	4.8	2.4	3.9	3.0	2.1
	Leg and foot fractures	5.9	9.3	7.3	8.8	10.2	4.9	6.9	7.7	7.6	6.9	9.5
	Leg and foot stress fractures	9.9	8.2	5.6	4.4	7.1	5.9	5.5	8.6	7.0	4.8	5.9
	Other leg/foot/ankle injuries	2.4	2.8	2.2	2.1	2.1	3.4	2.9	2.4	3.0	2.5	2.6
Medical illness	Medical illnesses	2.6	2.2	1.8	4.1	1.8	1.7	1.3	2.0	1.4	1.4	1.3
	ALL INJURIES	3.7	3.4	3.0	3.3	3.4	3.8	3.5	3.7	3.5	3.8	4.0

Table 13 – Injury prevalence by player age

Body area	Injury category	<21	21-23	24-26	27-29	30+
Head/neck	Concussion	1.1	0.9	0.9	0.8	1.5
	Facial fractures	1.5	2.7	2.3	2.3	2.0
	Neck sprains	0.3	0.2	0.3	0.8	2.6
	Other head and neck injuries	0.4	0.0	0.1	1.0	0.4
Shoulder/arm/elbow	Shoulder sprains and dislocations	4.4	4.6	5.5	4.0	4.0
	A/C joint injuries	2.6	2.2	1.9	1.5	1.2
	Fractured clavicles	1.8	1.3	1.2	1.5	0.8
	Elbow sprains or joint injuries	0.7	0.2	0.7	0.6	0.2
Forearm/wrist/hand	Other shoulder/arm/elbow injuries	1.2	1.4	0.9	2.1	2.1
	Forearm/wrist/hand fractures	5.6	4.2	3.9	6.1	7.5
Trunk/back	Other forearm/wrist/hand injuries	1.0	1.2	1.0	0.5	0.4
	Rib and chest wall injuries	1.4	1.5	1.9	1.8	2.7
	Lumbar and thoracic spine injuries	4.5	4.0	7.2	11.5	13.3
Hip/groin/thigh	Other trunk/back/buttock injuries	1.3	1.3	3.8	3.1	1.8
	Groin strains and osteitis pubis	12.0	10.8	12.9	8.8	10.3
	Hamstring strains	15.0	17.8	24.6	27.3	32.3
	Quadriceps strains	5.7	7.6	6.5	5.6	4.9
	Thigh and hip haematomas	1.9	1.7	2.1	1.4	0.7
Knee	Other groin/hip/thigh injuries	0.7	1.3	0.9	2.0	0.7
	Knee ACL	9.4	14.4	17.0	13.4	13.8
	Knee MCL	2.8	4.2	4.1	7.1	3.9
	Knee PCL	2.3	3.7	3.5	4.4	3.8
	Knee cartilage	5.6	3.4	10.1	13.6	8.6
	Patella instability	1.6	2.1	1.1	1.0	1.1
	Knee and patella tendon injuries	1.6	2.5	2.7	1.4	3.7
Shin/ankle/foot	Other knee injuries	2.1	2.2	2.6	3.2	6.6
	Ankle sprains or joint injuries	5.8	5.8	4.9	6.9	9.0
	Calf strains	1.8	2.2	6.5	10.1	12.0
	Achilles tendon injuries	0.5	0.5	2.7	2.2	5.5
	Leg and foot fractures	4.6	8.1	6.4	2.5	3.9
	Leg and foot stress fractures	6.9	6.3	3.6	1.9	0.0
Medical illness	Other leg/foot/ankle injuries	3.2	3.8	5.4	3.8	3.7
	Medical illnesses	4.1	2.4	2.5	2.8	4.2
	TOTAL MISSED GAMES	115.3	127.2	151.6	157.2	169.1

Table 14 – Injury match incidence (injuries per 1000 player hours) by Penetrometer first drop

Body area	Injury category	Harder (2.5 or less)	Medium (2.6-3.0)	Softer (3.1 or greater)
Head/neck	Concussion	0.8	0.6	0.6
	Facial fractures	0.4	0.3	1.1
	Neck sprains	0.1	0.1	0.1
	Other head and neck injuries	0.2	0.2	0.1
Shoulder/arm/elbow	Shoulder sprains and dislocations	0.7	0.9	0.6
	A/C joint injuries	1.1	0.5	0.5
	Fractured clavicles	0.3		0.2
	Elbow sprains or joint injuries		0.2	0.1
	Other shoulder/arm/elbow injuries	0.5	0.3	0.3
Forearm/wrist/hand	Forearm/wrist/hand fractures	1.5	0.8	1.0
	Other forearm/wrist/hand injuries	0.2	0.2	0.4
Trunk/back	Rib and chest wall injuries	0.4	0.6	0.7
	Lumbar and thoracic spine injuries	0.4	1.2	0.8
	Other trunk/back/buttock injuries	0.5	0.3	0.4
Hip/groin/thigh	Groin strains and osteitis pubis	1.4	1.7	1.7
	Hamstring strains	5.1	4.5	3.4
	Quadriceps strains	0.9	1.2	0.6
	Thigh and hip haematomas	1.4	1.2	0.9
	Other groin/hip/thigh injuries		0.2	0.1
Knee	Knee ACL	0.8	0.6	0.5
	Knee MCL	0.8	0.9	1.2
	Knee PCL	1.0	0.5	0.6
	Knee cartilage	0.8	0.9	0.5
	Patella injuries	0.1	0.2	0.1
	Knee and patella tendon injuries	0.1	0.1	0.2
	Other knee injuries	0.5	0.6	0.7
Shin/ankle/foot	Ankle sprains or joint injuries	1.8	2.1	2.2
	Calf strains	1.4	1.0	1.0
	Achilles tendon injuries	0.3	0.3	0.2
	Leg and foot fractures	0.7	0.7	0.4
	Leg and foot stress fractures	0.3	0.1	0.1
	Other leg/foot/ankle injuries	1.8	1.3	0.7
Medical illness	Medical illnesses	0.3	0.2	0.2
	ALL INJURIES	26.4	24.6	22.3

REFERENCES

1. Seward H, Orchard J, Hazard H, Collinson D. Football Injuries in Australia at the elite level. *Medical Journal of Australia* 1993;159:298-301.
2. Orchard J, Seward H. Epidemiology of injuries in the Australian Football League, seasons 1997-2000. *British Journal of Sports Medicine* 2002;36:39-45.
3. Orchard J, Best T. The Management of Muscle Strain Injuries: An Early return Versus the Risk of Recurrence [guest editorial]. *Clinical Journal of Sport Medicine* 2002;12:3-5.
4. Orchard J. The AFL Penetrometer study: work in progress. *Journal of Science and Medicine in Sport* 2001;4(2):220-232.
5. Orchard J. The 'northern bias' for injuries in the Australian Football League. *Australian Turfgrass Management* 2000;23(June):36-42.
6. Orchard J. Is there a relationship between ground and climatic conditions and injuries in football? *Sports Med* 2002;32(7):419-432.
7. Orchard J, Seward H, McGivern J, Hood S. Rainfall, evaporation and the risk of non-contact Anterior Cruciate Ligament knee injuries in the Australian Football League. *Medical Journal of Australia* 1999;170:304-306.
8. Norton K, Schwerdt S, Lange K. Aetiology of injuries in Australian football. *British Journal of Sports Medicine* 2001;35:418-423.
9. Norton K, Craig N, Olds T. The evolution of Australian football. *Journal of Science and Medicine in Sport* 1999;2(4):389-404.
10. Orchard J, Seward H, McGivern J, Hood S. Intrinsic and Extrinsic Risk Factors for Anterior Cruciate Ligament Injury in Australian Footballers. *American Journal of Sports Medicine* 2001;29(2):196-200.
11. Verrall G, Slavotinek J, Barnes P, Fon G, Spriggins A. Clinical risk factors for hamstring muscle strain injury: a prospective study with correlation of injury by magnetic resonance imaging. *British Journal of Sports Medicine* 2002;35:435-439.
12. Bennell K, Wajswelner H, Lew P, Schall-Riauour A, Leslie S, Plant D, et al. Isokinetic strength testing does not predict hamstring injury in Australian Rules footballers. *British Journal of Sports Medicine* 1998;32:309-314.
13. Orchard J. Intrinsic and Extrinsic Risk Factors for Muscle Strain Injury in Australian Footballers. *American Journal of Sports Medicine* 2001;29(3):300-303.