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PRIORITIES FOR INVESTMENT IN INJURY PREVENTION IN COMMUNITY AUSTRALIAN FOOTBALL

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Abstract (229 words)

Objective: High quality sport-specific information about the nature, type, cause and frequency of injuries is needed to set injury prevention priorities. This paper describes the type, nature and mechanism of injuries in community Australian Football (community AF) players, as collected through field-based monitoring of injury in teams of players.

Data sources: Compilation of published prospectively collected injury data from three studies in junior community AF (1202 injuries in 1950+ players) and three studies in adult community AF (1765 injuries from 2265 players). This was supplemented with previously unpublished data from the most recent adult community AF injury cohort study conducted in 2007-2008. Injuries were ranked according to most common body regions, nature of injury and mechanism.

Main results: In all players**, l**ower limb injuries were the most frequent injury in community AF and were generally muscle strains, joint sprains and superficial injuries. These injuries most commonly resulted from incidental contact with other players, or from “overexertion”. Upper limb injuries were less common but included fractures, strains and sprains; **they** were generally caused by incidental contact between players and the result of players falling to the ground.

Conclusions: Lower limb injuries are common in community AF and could have an adverse impact on sustained participation in the game. Based on their mechanisms, it is likely that a high proportion of lower limb injuries could be prevented and they should therefore be a priority for injury prevention in community AF.

Keywords: sports injury prevention, Australian football, injury frequency, lower limb injury

Introduction

Sports bodies have a duty of care to their participants, including doing what they can to maximise safety and reduce injury risk across all levels of participation. To be most effective, implementation of injury prevention programs, and the allocation of appropriate resources and infrastructure to support them, need to target specific injury prevention priorities within each sport. High quality sport-specific information about the nature, type, cause and frequency of injuries is needed to set these priorities.[1]

As a rule, public health agencies determine injury prevention priorities based on (a) measures of injury burden (e.g. mortality, disability adjusted life years); (b) the relative frequency of injury types and/or external causes of injury events across different settings or contexts; and (c) the potential preventability of these injuries.[2 3] Descriptive case series studies, routine surveillance systems in treatment settings and other specialised data collection methods can all provide useful information to help prioritise targets for injury prevention at the population level. The same is true when prioritising injury prevention for a single sport. Identifying the most common injuries and causal factors is a crucial first step in reducing injuries in any sport.[4 5] Sports bodies generally prioritise safety initiatives for a range of factors including to improve team performance, reduce the risk of successful litigation and to encourage higher participation levels.[6 7] Nonetheless, compelling arguments about the frequency, causes and preventability of injuries in their sport are also important for them to decide which injuries to focus on.

Australian football (AF) is a popular team sport in Australia, with competitions ranging from the elite (i.e. professional and talent development pathways) levels to broader community participation (i.e. recreational, amateur and junior). As with all sports, there is a risk of injury when playing AF and the peak body, the Australian Football League (AFL), and its state/regional associations, share the responsibility for introducing measures to manage this

risk. Most of the available information about AF injuries arises from research involving elite players only. This is a problem because the elite and community forms of the game are very different in terms of their intensity, playing and ground conditions, skill levels, rules (especially for junior players) and player conditioning and these factors all impact on injury risk differently. Moreover, over 99% of all AF players do not play the elite form of the game and would be expected to comprise the largest component of the injury burden. Since the early 1990s, detailed injury surveillance reports have been published annually by the AFL for elite competition, enabling comparisons of injury patterns across seasons.[8] These reports have prompted the AFL to introduce preventive initiatives that have reduced rates of some injuries in elite players.[9] Community AF refers to all levels of the game other than the national elite AFL competition (or its Victorian Football League predecessor) or the elite junior AF pathway competitions. There is a recognised need to also prioritise injury prevention in community AF.[10] However, since there has been considerably less attention given to robust injury surveillance in community AF to date, it has not been possible to develop a strategic approach towards injury prevention for this level of play.

Several population health surveys of the general population and regular telephone surveys of community AF players have provided some limited information about community AF injuries.[11-13] There has been several reported case-series of community AF injuries treated in various medical settings including hospitalisations,[14-17] emergency departments [14 18 19] and sports medicine clinic presentations.[20] However, these studies do not provide a representative picture of all community AF-injuries and the case-series studies are typically limited to only the most severe injuries. Injury profiles based on hospital treatment case-series are quite different to those based on field-based data collections within teams because of the threshold of injury severity needed for the former and the fact that not all injuries require hospital-treatment. Field-based, team level, injury data collections have the potential to capture injuries of all severity, not just those needing medical or hospital treatment.

To date, there has been no published compilation of the injury patterns identified from team-based studies within community AF. This paper summarises what is known about the type, nature and mechanism of community AF injuries using field-based injury monitoring methods. This information is important because the design and implementation of preventive programs at the team level requires information from the specific context in which injuries occur. The collated injury information will be used to identify targets and priorities for injury prevention efforts in this popular sport.

Methods

A systematic search strategy was used to identify peer-reviewed papers presenting original data describing injuries in community AF players published prior to January 2012. The review was restricted to community AF studies that involved field-based data collection of injuries sustained by players recruited from clubs/teams. Papers were identified through keyword searches of the following electronic databases: Academic Search Premier, AMI, APAIS-Health, ATSIHealth, AUSPORT, AUSPORTMed, BMJ, CINAHL Plus, CINCH-Health, Cochrane Library, DRUG, Family & Society Plus, Family, Health Source Consumer, Google Scholar, Health Source Nursing, MEDLINE, SPORTDiscus and SpringerLink. The tables of contents of the Journal of Science and Medicine in Sport and the British Journal of Sports Medicine, as the two journals most likely to have published relevant community AF studies over 1990–2011, were also hand searched to confirm our search identified relevant studies. The searches were facilitated by use of the keywords “Australia/Australian” and “football” together with “injury/injuries/injured”.

All identified papers were obtained and read in full (n=17). Only papers containing details on the nature of injury and body region injured were retained (n=6) as the aim of this paper was to describe injury frequency in relation to injury types . Three papers were identified that reported data for only specific types of injuries (e.g. hamstring injuries[21]; lower limb injuries

[22]; head/neck facial injuries[23]) but these were all subsets of more general studies.[24 25] These were excluded from the tabular displays but are discussed in the text, where relevant. When the retained studies contained information about factors that may have contributed to the injury or the initial event that led to the injury (injury mechanism), this was also extracted and summarised. The category descriptions used in the original papers were retained, even though some were non-specific or unclear, to avoid incorrect interpretation of the their initial meanings as used in the reported studies. No quality assessment of the papers was undertaken, but a summary of the key definitions and research methods used are summarised in Table 1.

<Table 1 about here>

The published injury data were extracted and compiled into summary tables showing the proportion of all reported injury cases. Across the studies, the classification of the injured body region and nature of injury detail varied from quite specific (e.g. ligament sprain of ankle) to being more general (e.g. lower limb). For this reason, the data are summarised according to the categories given in the source papers. It was not always possible to extract exact percentages because some papers only presented data in graphical form, and in these instances the data is not included in the tables. The tables are restricted to figures that represented 5% or more of all injury cases, to ensure adequate numbers of injuries to guide priority setting. Injury priorities were identified by the highest-ranking (i.e. highest frequency) injury types.

Previously unpublished community AF data from the Preventing Australian Football Injuries through eXercise (PAFIX) study[26] was also summarised as above and added to the various tables. The PAFIX study was the most recent and largest community AF cohort injury study and involved field-based monitoring of injuries in 1564 players from 10 clubs in Victoria and eight clubs in Western Australia. Full details of the PAFIX study design and data collection methods are published elsewhere[26 27] and summarised in Table 1. The PAFIX

study was approved by the University of Ballarat and University of Western Australia Human Ethics Committees.

Results

The search identified six published community AF studies, three in junior players and three in adult players. The three junior community AF studies were conducted in Victoria in 1992,[28] in South Australia in 1999[29] and in New South Wales/Victoria in 2003.[30] Collectively, they published data on 1202 injuries in 1950+ players from 80+ junior teams. The published adult studies were conducted in 1993,[31] 1999[21 22 24] and 2001,[23 25] with the first two reporting injuries in the Victorian amateur football league and the 2001 study involving a Victorian senior community competition. All studies, except for the earliest amateur football study,[31] reported injuries during both games and training sessions. Together with the new PAFIX data included in this paper, the adult studies provide information on 1765 injuries in 2265 players from 70 adult football teams.

Table 1 summarises the reported data collection methods, sampling processes and definitions used in the papers identified from the literature, as well as the PAFIX study. In each case, field-based designated data collectors gathered details of injuries at the time (or very shortly after) they occurred during a game and/or training session. The adopted sampling procedures identified specific clubs/teams and injuries to players from those groups were monitored over one playing season. Most injury definitions included both medical treatment/assessment and time loss components.

The papers generally provided injury information on the nature of injury or body region injured, separately, without linking them (e.g. all strains combined, or all knee injuries combined). One published study[24] used the Orchard Sports Injury Classification System (OSICS),[32] which was developed in 1992 and used in all elite AF injury studies since then,

to describe specific injury types. The OSICS-10 was also used to code injuries in the PAFIX study. Detailed information about specific types of injuries (and specific diagnoses) was therefore generally not available from the studies.

From all the body regions injured among community AF players most injuries occurred to the lower limb (Table 2). Injuries to the knee, ankle and upper leg (e.g. hamstring, thigh, etc) were particularly common across all studies and shoulder injuries were relatively common in the adult studies. Most studies reported a preponderance of sprains/strains (19–50%) or a range of superficial injuries (5–47%) (Table 3).

<Tables 2 and 3 about here>

In both the new PAFIX data and the most recent study of amateurs,[24] the most common individual OSICS diagnoses were hamstring muscle strains (12% in PAFIX, 14% in amateurs), lateral ligament sprains of the ankle (11% and 7%, respectively) and thigh haematomas (5% and 10%, respectively). Together, these three lower limb injuries accounted for just under one third of all injuries (28% in PAFIX, 31% in amateurs). Similarly, in senior competition the single most common injury was a hamstring strain/tear (7%).[25] Lower limb injuries were also the most common in junior players and these were typically sprain/strains, bruises/haematomas, swelling/inflammation and cuts/bruises (Table 3).[28 30] A detailed description of 109 lower limb injuries sustained by senior amateur players,[22 24] found the most common diagnoses were hamstring muscle strain (24%), lateral ligament sprain of the ankle (13%), cartilage injury of the knee and thigh haematoma (both 9%).

In a sub-study describing 37 head/neck/orofacial injuries in senior players,[23 25] the most common injury was a facial laceration (38%) followed by concussion (19%) and dental injury (11%).

Contact injuries were the most common in every study and were mostly the result of unintentional contact with another player during games (Table 4). This is in contrast to

studies in elite players where non-contact injury mechanisms were more common.[8] In the earliest junior study,[28] 21% of injuries occurred while tackling, bumping and shepherding; 20% while marking the ball; 16% while gathering the ball; 8% while kicking or handballing. Rapid acceleration/deceleration and twisting/changing direction were identified as non-contact mechanisms of acute injuries.[28]

<Table 4 about here>

Most studies provided the mechanism of injury for all injuries combined rather than for specific body regions or injury types. One junior study reported that the most common mechanism of knee, ankle, calf/lower limb and forearm/hand injuries was a collision.[29] The most common mechanism of shoulder injuries was a fall to the ground or a jump, and the most common mechanism of skull injuries was "slips and trips on the ground". The most commonly reported mechanisms for hamstring, feet and trunk injuries were “overuse”. Collisions, falls/jumps from a height and “overuse” all contributed equally to groin injuries.

Discussion

Comprehensive epidemiological information about injuries sustained in sport is needed to inform and prioritise sports injury prevention intervention development and implementation.[45] Most AF injury research to date has been conducted in elite players and only a limited number of studies have described injuries in community AF. Although the review is restricted to Australian Football injuries, the findings do have some relevance to other sports globally as the game has been described as a combination of aspects of soccer, gaelic football and rugby.

This paper provides the first compilation of information about the profile of community AF injuries that draws explicitly on original data collected through field-based injury data collection in clubs/teams in juniors and seniors/reserves/amateurs. It draws on injury data

describing 1765 injuries in 2265 adult players and 1202 injuries in over 1950 junior players. There has been no report of injuries in teams of junior AF players since the 2004 season and none in adults since the 2001 season. This paper draws on published evidence from a decade ago and the injury patterns may have changed since then. Inclusion of the more recent PAFIX data is therefore invaluable in providing more recent data on injuries in this sport. Nonetheless, the data compilation in this paper has identified the most commonly injured body regions, natures and mechanisms of injury experienced by the largest participation groups in this sport. Examination of the relative rankings of injury frequencies identifies some potential priorities for injury prevention.

The extent to which injuries can be adequately described and correctly assigned to body region, nature and diagnostic characteristics depends upon the training and experience of the data collector. This particularly limits the quality of specific injury details such as nature and diagnosis of injury. Only one study used physiotherapists as data collectors.[24] All others used club-nominated personnel ranging from coaches to parents to team managers and sports trainers, who were trained by the researchers and have generally been shown to provide accurate information.[27 33]

All reviewed studies used field-based injury data collection and it is reasonable to expect that this approach captures most injuries that occur during community AF, especially traumatic injuries. Most studies used an injury definition incorporating both immediate time-loss and medical treatment components. However, it is possible that chronic and overuse injuries, which were not reported or observed during a game or training session, or did not impact on participation until well after the game, may have been under-reported as has also been commented on for other sports injury settings [34]. This could lead to a reporting bias in field-based data collections if overuse injuries are not treated on the field and hence are not ascertained with the same level of accuracy.

Superficial (e.g. grazes, minor cuts, abrasions, etc) and sprain/strain injuries were the most commonly reported injuries. Most superficial injuries can be treated directly at the side of a football field by medical support staff or first-aid personnel[35 36]and are therefore more likely to have complete capture in field-based data collections than other injuries types. However, depending on the injury definition used, very low severity injuries (e.g. blisters or minor scratches, etc) may be under-reported in some papers.

Taken together, the compiled body region and nature of injury findings indicate that superficial injuries (e.g. bruises, lacerations, etc) and sprains/strains are the most common lower limb injuries, while fractures and sprains/strains are the most common upper limb injuries. This is not surprising as AF involves physical competition for a fast-moving ball, incidental and intentional contact amongst players, large distances covered whilst running and other physical manoeuvres such as sudden accelerations/decelerations, change of direction and jump/landing actions. It will be important that prevention programs are developed to reduce injury risk whilst maintaining these inherent game characteristics.

The reported injury mechanisms provide some evidence for the prevention of these injuries. The most common mechanism of injury reported in all studies was contact with a person, which is not surprising given that body contact is an inherent part of the game. Acute "overexertion" and contact with a moving object (in this case a football) also featured highly.

Limitations of the reviewed studies

Unfortunately, few studies reported exactly how the injuries occurred, even during body contact, and this limits the extent to which these descriptive findings can directly inform the development of interventions. It should be noted that whilst several studies used the term "overexertion" this is a non-specific category that could cover a range of actions ranging from overextension, sudden or rapid movements and other strenuous activities. As the authors did not report what this category explicitly did/did not include, it is not possible to report the injury mechanisms more precisely.

Another challenge in interpreting the data from this compilation, and translating it to clearly actionable injury priorities, is the fact that most studies used largely uninformative categories to describe the reasons why injuries occurred. Often the terms “cause” and “mechanism” were used interchangeably and in some cases the inciting cause of the injury event (e.g. a tackle) was reported rather than the specific underlying injury mechanism (e.g. twisted knee). The mixture of information about what caused the inciting event and what caused the tissue damage during that event is problematic because the two are not necessarily the same and both pieces of information are needed to inform prevention efforts.[37] For example, reporting that a player was injured during a fall does not necessarily specify the injury mechanism because the actual tissue damage could arise from different biomechanical causes such as impact with a hard ground, colliding with another player during the fall, or twisting/turning of a joint. Even when more detail is provided, identifying the exact point in a chain of events during an inciting event when the injury or tissue damage occurs can be difficult.

Another limitation of many of the reviewed studies, and hence the summaries provided here, was the largely univariable approach taken to reporting the study findings. The papers generally reported separate listings of body region, nature of injury or injury mechanism across all reported injuries and rarely linked them or sub-classified the categories according to a different injury characteristic. Whilst broad categories of injuries can be identified for preventive action, it is not always possible to rank the relative importance of specific injuries (e.g. muscle injuries versus joint strains) or types of injury mechanism (e.g. contact versus non-contact) within body region categories. Moreover, the lack of a standardised reporting of injury characteristics across specific categories and inconsistent injury definitions means that direct comparison of the published studies is not possible. The two studies to apply OSICS codes found the most common individual injury diagnoses to be hamstring strains, lateral ligament sprains of the ankle and quadriceps muscle haematomas.

As stated previously, the public health approach to priority settings considers injury burden, frequency and preventability. Based on the most common injury types and their likely causes, this review has highlighted priorities for the latter two aspects. A limitation of the studies reviewed here is that none included follow-up of the injured players and so the severity of the injury and its long-term consequences were not reported. Because of the lack of information about injury severity and outcomes in the published papers, it is not possible to determine the burden placed on injured players, their sports teams and sports participation more generally from the published studies. This paper summarises the evidence from all published studies of injury incidence in well defined “at-risk” groups of community players and is necessarily limited by the timeframes of those studies. Inclusion of the most recently available data from our own PAFIX study, shows that there have been no major changes in injury profiles compared to the earlier studies, probably reflective of few changes to the community AF version of the game.

Further Research

The varied injury definitions used in the studies summarised in this paper, reflects the lack of clear guidance on injury surveillance in community sport settings. Whilst the Australian Sports Injury Data Dictionary [38] was developed for this purpose and used in several of the studies, there is a need to revise the ongoing use and relevance of these injury surveillance guidelines to community sport.

Whilst many injuries are successfully assessed and/or treated on the sideline,[35] this review and the studies it is based upon gives no information about either the ongoing treatment/rehabilitation needs of injured players or both immediate and long-term impacts on participation. This is an area where future research would be beneficial.

Overall, there is a lack of information about the types of injuries that are most likely to be associated with long-term treatment needs or physical disability (e.g. osteoarthritis later in life) or loss of participation in community AF players. It is recommended that well-designed

longitudinal studies are conducted to document and describe the longer-term impacts of injuries sustained by players across all participation levels. In addition, sport clubs, coaches or players may be more focused on performance, fielding a competitive team and having players remain on the field so priority would be given to preventing injuries that are more likely to cause game time-loss.[6]

Finally, to identify targeted preventive solutions more accurately in the future, it is recommended that biomechanists and sports injury epidemiologists collaborate to improve the collection and coding of data relating to both the causes and mechanisms of injury in field-based studies.

Conclusions

While direct links between body region, nature and mechanism were not reported in the published studies, the following conclusions can be drawn:

1. Lower limb injuries are the most common community AF injuries in both adults and juniors. They consist mainly of sprains/strains and superficial injuries. They are most commonly the result of contact with other players as is inherent in the game, being hit by the ball, or by some players overextending themselves during a landing from a fall or mark.

2. Upper limb Injuries are less common but potentially more severe, consisting of fractures and sprains/strains that often require medical attention. They are largely caused by contact between players and players falling to ground.

Based on the injury data compiled in this paper, the prevention of lower limb injuries in community AF should be a particular priority on both a frequency basis and because of the available information about some of the game features most associated with them. They could also be expected to have an adverse impact on short-term and sustained participation in the game. Lower limb injury prevention has been previously recommended as a priority for

AF.[10 39] This paper confirms this priority ranking for community AF through a current literature review and inclusion of new data about injuries in community AF.

It is beyond the scope of this paper to review the evidence for the efficacy and effectiveness of the specific interventions that could be used to prevent or reduce community AF injuries in the future. Nonetheless, based on Haddon's first principles and hierarchy of injury control,[40] future lower limb injury prevention interventions in community AF should focus on:

a) reducing the magnitude of the impacts sustained during physical contact amongst players by teaching players how to tackle safely and how to be tackled safely (e.g. as is currently done within modified rules for children);

b) managing and/or reducing the amount and certain types of adverse physical strain that players place on their muscles and tendons through over strenuous movements (of various mechanical kinds); and

c) increasing the resilience of players' body tissues and joints to withstand both overuse and physical contact with others through improved tissue responses to the transfer of impact forces.

Recent prevention research has largely focussed on strategy c) and various programs have been built around improving player conditioning and preparation through strengthening or functional training programs developed in elite AF and other football codes.[41-47] Whilst there is a substantial scientific evidence-base for such programs, it is clear that translation of this evidence is limited and similar programs are not widely implemented within community AF.[48-50]

In terms of upper limb injury prevention interventions in community AF, Haddon's hierarchy of control,[40] would suggest focussing on:

a) reducing impact forces by teaching players how to tackle, bump and fall/land safely from a mark;

b) improving players' ability to withstand the impact forces experienced during body contact and falls, including through strength and conditioning exercises, the use of protective equipment, and improvements to the ground surfaces on which the game is played.

References

1. Finch C. An overview of some definitional issues for sports injury surveillance. *Sports Med.* 1997;**24**:157-63.
2. Wiebe DJ, Nance ML, Branas CC. Determining objective injury prevention priorities. *Inj Prev.* 2006;**12**:347-50.
3. Finch C. Getting sports injury prevention onto public health agendas – addressing the shortfalls in current information sources. *Br J Sports Med.* 2012;**46**:70-74.
4. van Mechelen W. Sports injury surveillance systems 'One size fits all?'. *Sports Med.* 1997;**24**:164-68.
5. Finch C. A new framework for research leading to sports injury prevention. *J Sci Med Sport.* 2006;**9**:3-9.
6. Finch CF. Different injury settings require different cost severity thresholds. *Inj Prev.* 2012:10.1136/injuryprev-2012-040416.
7. Poulos R, Donaldson A, Finch C. Towards evidence informed sports safety policy for NSW, Australia: assessing the readiness of the sector. 2010;**16**:127-31.
8. Orchard J, Seward H, Orchard J. 20th Annual Injury Report. Season 2011: Australian Football League., 2012.
9. Orchard J, Seward H. Decreased incidence of knee posterior cruciate ligament injury in Australian Football League after ruck rule change. *Br J Sports Med.* 2009;**43**:1026-30.
10. Gabbe B, Finch C, Cameron P. Priorities for reducing the burden of injuries in sport: The example of Australian football. *J Sci Med Sport* 2007;**10**:273-76.
11. Mummery W, Schofield G, Spence J. The epidemiology of medically attended sport and recreational injuries in Queensland. *J Sci Med Sport.* 2002;**5**:307-20.
12. McManus A, Stevenson M, Finch C, et al. Incidence and risk factors for injury in non-elite Australian Football. *J Sci Med Sport.* 2004;**7**:384-91.
13. Finch C, Cassell E. The public health impact of injury during sport and active recreation. *J Sci Med Sport.* 2006;**9**:490-97.
14. Cassell E, Finch C, Stathakis V. Epidemiology of medically treated sport and active recreation injuries in the Latrobe Valley, Victoria, Australia. *Br J Sports Med.* 2003;**37**:405-09.
15. Gabbe BJ, Finch CF, Cameron PA, et al. Incidence of serious injury and death during sport and recreation activities in Victoria, Australia. *Br J Sports Med.* 2005;**39**:573-77.
16. Flood L, Harrison J. Hospitalised sports injury, Australia 2002-2003. Injury Research and Statistics Series Number 27. Adelaide: Australian Institute of Health and Welfare., 2006.
17. Finch C, Boufous S, Dennis R. Sports and leisure injury hospitalisations in NSW, 2003-2004: sociodemographic and geographic patterns and sport-specific profiles: NSW Injury Risk Management Research Centre, 2007.

18. Finch C, Valuri G, Ozanne-Smith J. Sports and active recreation injuries in Australia: evidence from emergency department presentations. *Br J Sports Med.* 1998;**32**:220-25.
19. Crowe LM, Anderson V, Catroppa C, et al. Head injuries related to sports and recreation activities in school-age children and adolescents: data from a referral centre in Victoria, Australia. *Emerg Med Aust.* 2010;**22**:56-61.
20. Gabbe B, Finch C. A profile of Australian football injuries presenting to sports medicine clinics. *J Sci Med Sport.* 2001;**4**:386-95.
21. Gabbe B, Finch C, Bennell K, et al. Risk factors for hamstring injuries in community level Australian football. *Br J Sports Med.* 2005;**39**:106-10.
22. Gabbe B, Finch C, Wasjswelner H, et al. Predictors of lower extremity injuries at the community level of Australian football. *Clin J Sport Med.* 2004;**14**:56-63.
23. Braham R, Finch C, McCrory P. The incidence of head/neck/or facial injuries in non-elite Australian Football. *J Sci Med Sport.* 2004;**7**:451-53.
24. Gabbe B, Finch C, Wajswelner H, et al. Australian football: injury profile at the community-level. *J Sci Med Sport.* 2002;**5**:149-60.
25. Braham R, Finch C, McIntosh A, et al. Community level Australian football: a profile of injuries. *J Sci Med Sport.* 2004;**7**:96-105.
26. Finch C, Lloyd D, Elliott B. The Preventing Australian Football Injuries with eXercise (PAFIX) study - a group randomised controlled trial. *Inj Prev.* 2009;**15**:e1 doi: 10.1136/ip.2008.021279.
27. Twomey D, Finch C, Doyle T, et al. Level of agreement between field-based data collectors in a large scale injury prevention randomised controlled trial. *J Sci Med Sport.* 2011;**14**:121-25.
28. McMahon KA, T. Nolan, C. M. Bennett, et al. Australian Rules football injuries in children and adolescents. *Med J Aust.* 1993;**159**:301-06.
29. Grimmer K, Williams J. Injury in junior Australian rules footballers. *J Sci Med Sport.* 2003;**6**:328-38.
30. Romiti M, Finch CF, Gabbe B. A prospective cohort study of the incidence of injuries among junior Australian football players: evidence for an effect of playing-age level. *Br J Sports Med.* 2008;**42**:441-6.
31. Shawdon A, Brukner P. Injury profile of amateur Australian rules footballers. *Aust J Sci Med Sport.* 1994;**26**:59-61.
32. Rae K, Orchard J. The Orchard sports injury classification system (OSICS) version 10. *Clin J Sport Med.* 2007;**17**:201-04.
33. Braham R, Finch C, McCrory P. Sports trainers have accurate but incomplete recall of injury details. *Br J Sports Med.* 2003;**37**:561.
34. Clarsen B, Myklebust G, Bahr R. Development and validation of a new method for the registration of overuse injuries in sports injury epidemiology: the Oslo Sports Trauma Research Centre (OSTRC) Overuse Injury Questionnaire [Published Online First October, 4, 2012]. *Br J Sports Med.* 2012:10.1136/bjsports-2012-091524.
35. Verrall GM, Brukner PD, Seward HG. Doctor on the sidelines. *Med J Aust.* 2006;**184**:244-8.
36. Donaldson A, Finch C. Identifying context-specific competencies required by community Australian Football sports trainers. *Br J Sports Med.* 2012;**46**:759-66.
37. Finch C, Ullah S, McIntosh A. Combining epidemiology and biomechanics in sports injury prevention research - a new approach for selecting suitable controls. *Sports Med.* 2011;**41**.
38. Australian Sports Injury Data Working Party. Australian Sports Injury Data Dictionary: guidelines for injury data collection and classification for the prevention and control of injury in sport and recreation. Canberra: SportSafe Australia (Australian Sports Commission) and Sports Medicine Australia, 1998.
39. Gabbe B, Finch C, Wajswelner H, et al. Does community-level Australian football support injury prevention research? *J Sci Med Sport.* 2003;**6**:231-36.
40. Haddon WJ. Energy damage and the 10 countermeasure strategies. *J Trauma.* 1973;**13**:321-31.

41. Verrall G, Slavotinek J, Barnes P. The effect of sports specific training on reducing the incidence of hamstring injuries in professional Australian Rules football players. 2005;**39**:363-68.
42. Gabbe B, Branson R, Bennell K. A pilot randomised controlled trial of eccentric exercise to prevent hamstring injuries in community-level Australian football. *J Sci Med Sport.* 2006;**9**:103-09.
43. Dempsey A, Lloyd D, Elliott B, et al. The effect of technique change on knee loads during sidestep cutting. *Med Sci Sports Exerc.* 2007;**39**:1765-73.
44. Engebretsen AH, Myklebust G, Holme I, et al. Prevention of injuries among male soccer players: a prospective, randomized intervention study targeting players with previous injuries or reduced function. *Am J Sports Med.* 2008;**36**:1052-60.
45. Dempsey A, Lloyd D, Elliott B, et al. Changing sidestep cutting technique reduces knee valgus loading. *Am J Sports Med.* 2009;**37**:2194-200.
46. Cochrane J, Lloyd D, Besier T, et al. Training affects knee kinematics and kinetics in cutting maneuvers in sport. *Med Sci Sports Exerc.* 2010;**42**:1535-44.
47. Donnelly C, Elliott B, Ackland T, et al. Translating ACL injury prevention research to injury prevention practice: Incorporating the recent evidence. *Res Sports Med.* 2012;**20**:239-62.
48. Twomey D, Finch C, Roediger E, et al. Preventing lower limb injuries: is the latest evidence being translated into the football field? *J Sci Med Sport.* 2009;**12**:452-6.
49. Finch CF, White P, Twomey D, et al. Implementing an exercise-training programme to prevent lower-limb injuries: considerations for the development of a randomised controlled trial intervention delivery plan. *Br J Sports Med.* 2011;**45**:791-6.
50. Finch C, Gabbe B, Lloyd D, et al. Towards a national sports safety strategy – addressing facilitators and barriers towards safety guideline uptake (the NoGAPS project). *Inj Prev.* 2011;**17**:1-10.