IMPLEMENTING AN EXERCISE TRAINING PROGRAM TO PREVENT LOWER LIMB INJURIES – CONSIDERATIONS FOR THE DEVELOPMENT OF A RANDOMISED CONTROLLED TRIAL INTERVENTION DELIVERY PLAN

Caroline F Finch (1), Peta White (1), Dara Twomey (2), Shahid Ullah (2)

(1) Accident Research Centre, Monash University, VIC 3800, Australia

(2) School of Human Movement and Sport Sciences, University of Ballarat, VIC 3353, Australia

(Running Title: Exercise Intervention Delivery Plans)

ADDRESS FOR CORRESPONDENCE:

Professor Caroline F Finch

Accident Research Centre

Monash University, Clayton Campus

Victoria 3800, Australia

Ph: +419 464 350

Email: Caroline.Finch@monash.edu

Word count – 3180 (excluding title page, abstract, acknowledgements and tables)

ABSTRACT (250 words)

Objective: Whilst exercise training interventions are efficacious in preventing lower limb injuries, their uptake in formal randomised controlled trials (RCT) has been low or variable. This study aimed to identify important considerations for the delivery of an exercise training intervention in an RCT to maximize subsequent participation in the RCT and intervention uptake.

Design: A cross-sectional survey, with a theoretical basis derived from the Health Belief Model (HBM) and the RE-AIM framework.

Participants: 374 Australian Football players

Main outcome measurements: beliefs about lower limb injury causation/prevention, and the relative value of exercise training for performance and injury prevention. The data is interpreted within the constructs of the HBM and implications of findings for subsequent intervention implementation considered within the RE-AIM framework. Ordinal logistic regression was used to compare belief scores across player characteristics.

Results: Football players generally agree that doing specific exercises would reduce their risk of lower limb injury and would be willing to undertake them, but not at the cost of reducing training time that is perceived to improve performance. They are also largely unaware of recent research evidence on the role of landing and balance training in lower limb injury prevention. Beliefs were more related to player age and experience, than to prior injury history.

Conclusions: Delivery of future exercise training programs for injury prevention aimed at these players should be implemented as part of routine football activities, and integrated with those as standard practice, as a means of associating them with training benefits for this sport.

INTRODUCTION

Before efficacious injury prevention measures including exercise training programs, can be successfully incorporated into usual player safety behaviours and practices, it is necessary to know about likely barriers towards, and motivators for, their uptake.[1-2] A number of studies have described attitudes and behaviours in relation to protective equipment use in sports such as Australian Football,[3] rugby union[4] and squash[5] and shown how these can lead to sub-optimal uptake of this form of preventive measure. To date, there has been surprisingly little attention given to these same factors in relation to the delivery and uptake of other exercise training interventions for injury prevention, with only three previous studies reporting beliefs in relation to specific exercise training programs for lower limb injury prevention (LLIP) amongst basketball players,[6] Australian Football coaches,[7] and netball coaches.[8]

According to the ecological model,[2] and aetiological sports injury causation models,[9-10] many factors interact to produce a player's safety status.[2 11] Behavioural science theories, e.g. Health Belief Model (HBM)[12], have begun to play an important role in understanding and preventing unintentional injury.[13] Not withstanding this, their application to sports injury prevention has been minimal to date.[11] Another useful health promotion framework for understanding the implementation and evaluation contexts for prevention measures is RE-AIM,[14] which has recently been advocated specifically for the sports injury prevention context.[15] Despite its wider recognition in broader health and physical activity promotion settings, the RE-AIM framework with its reach, effectiveness, adoption, implementation and maintenance dimensions[16] has only started to be applied to sports injury prevention.[8 15]

Whilst it is critical that sports safety interventions have a strong efficacy evidence, there also needs to be a strong theoretical basis behind strategies aimed at implementing them in the real-world context of sport delivery, particularly at the community level.[15] The impact of non-adoption of components of specific exercise training programs on intervention effectiveness has been highlighted in recent randomized controlled trials (RCTs) of LLIP measures.[17-18] The results from the first implementation studies of the Federation Internationale de Football Association's *The 11*, for example, have shown limited success because few of the targeted participants adopted the program[17-18] and there was a perception that it was not relevant to the real-world community sport setting in which it was implemented.[19]

Despite the availability of targeted exercise training interventions for LLIP and increasing RCT evidence of their efficacy,[17 20-24] it is clear that broader LLIP efforts are hampered because little research has focused on understanding the intervention implementation context and processes, including barriers and facilitators to sustainable programs. For example, a recent study of coaches' attitudes towards the risk of LLIP through specifically targeted exercise programs in Australian Football concluded that coaches do not possess the latest knowledge about LLIP and hence do not give adequate attention to the development of training skills most likely to reduce the risk of lower limb injuries (LLI) in their players.[7]

There is a clear need for more information about players' attitudes and beliefs in relation to LLI causes, predisposing factors and preventive measures because this plays a determining role in their adoption of exercise training programs for safety gains. According to the (HBM),[25] there are four constructs that combine to explain the adoption of safety behaviours: *perceived susceptibility* (i.e. beliefs about the risk

of being injured), *perceived severity* (i.e. beliefs about the seriousness of sustaining an injury in terms of both health and sporting consequences), *perceived benefits* (i.e. beliefs about of the effectiveness of actions available to reduce injury risk), and perceived *barriers* (i.e. beliefs about the potential negative aspects of adopting a prevention measure). Whilst these four constructs represent an individual's 'readiness to act', the model also includes two other dimensions required to produce the desired outcome: *cues to action (*i.e. factors that would motivate a player to actually do something to prevent their injury) and *self-efficacy* (i.e. a player's belief in their ability to undertake exercise training).[12] Unfortunately, behavioural science theories such as the HBM have been underutilised in injury prevention and the potential benefits of their application[13] have not yet been fully realised for sports injury prevention.[26]

This paper reports the results from a study conducted to identify the best way to deliver an intervention in a large RCT of an exercise-based neuromuscular training program to prevent LLI in Australian Football. The methodology protocol for the full RCT has been published elsewhere.[27] The study's specific aim was to determine likely facilitators and barriers towards the delivery and uptake of exercise training programs in a representative sample of senior Australian Football players before significant effort and resources were invested in the conduct of the RCT. This information was then used to develop a specific targeted intervention delivery plan according to RE-AIM principles[14] that would ensure players' maximum participation with all study protocol requirements and maximum adoption of the intervention itself in the subsequent RCT. This paper describes the survey approach used for identifying the barriers and facilitators towards exercise training for LLIP and presents the key findings and their implications, for the exercise training program

delivery plan development. This paper also compares players' beliefs about the likely injury prevention and performance value of various training program components, so as to give additional guidance for the future marketing of the benefits of participating in an exercise intervention of this nature.

METHODS

Sampling

All nine senior clubs in the Premier Division (of the Sydney Australian Football League were purposively selected to participate and all agreed to do so. The research team attended each club on two consecutive training nights and all players aged 17+ years in attendance at ≥1 of these training sessions were invited to participate. Informed written consent was obtained from all consenting players who then completed a self-report questionnaire during a training session. Approval for the study was obtained from the University Ethics Committee.

Questionnaire design and construct

The questionnaire was modelled on previous studies of risk and safety attitudes in Australian Football players and coaches,[3 7 28] adjusted as necessary to focus on LLIs after ensuring face and content validity. Whilst not designed to directly adhere to specific HBM constructs, the questionnaire broadly drew on HBM components as recommended in a ecological model for protective equipment use.[2] The RE-AIM dimensions were used as the basis of determining question categories. Table 1 lists the 24 specific belief questions asked and shows their alignment to both the HBM constructs and RE-AIM dimensions. The HBM provided guidance in how to interpret

the players' beliefs whilst RE-AIM assisted with directing how these should inform the intervention delivery plan.

The survey also collected information about player characteristics (age, number of seasons played, level of competition, LLI previous season history) and their beliefs about which training program components are most beneficial for improving football performance and LLIP.

The self-report survey consisted of closed-option questions with specified tick-box responses and all belief statements were given as a five-point Likert scale ranging from 'strongly disagree' to 'strongly agree'.

Data analysis

All data were double entered into an SPSS database and analysed using R version 2.10.0.[29] All statistical analyses were adjusted for potential clustering effects because players were sampled from different clubs. All 5-point Likert scale variables were collapsed to three levels (strongly agree/agree; uncertain; strongly disagree/disagree) for analysis. Ordinal logistic regression analysis,[30] with club as a random effect, was used to identify significant relationships between behaviour belief responses and player characteristics after adjustment by controlling for all other responses and player characteristics. Descriptive statistics (%) for the listed training program components were used to identify differences in players' ratings of their importance for both performance and LLIP. A Wilcoxon signed rank test[31] was used to compare belief scores across performance and LLIP situations, taking into account the paired nature of the data.

Table 1: Categories of questions used on the survey, their alignment to the Health Belief Model (HBM) and the RE-AIM framework, players' summary responses and their relationship to player characteristics

Broad category /theme	Theoretical alignment		% of players giving this response [1]			p-values[2] for comparisons across player groups			
Exact wording of opinion statements on the survey	RE-AIM dimension relevant to[3]	HBM construct related to[4]	SA/A	U	SD/D	Age (years) (<25 vs 25+)	LLI in last season (no vs yes)	Number of seasons played (≤10 vs 10+)	Playing in most senior competition (no vs yes)
Attending a University lab for testing									
I would visit a university to test my AFL[5] skills if I thought this would help me to play better	E	CA	64.7	15.7	19.6	0.44	0.59	0.23	0.75
I would visit a university to test my AFL skills if I thought this decrease my risk of LLI	E	CA	58.2	20.5	21.3	0.60	0.13	0.90	0.71
Doing additional training outside of a club setting									
I would do extra training at home if I thought it would help me to play better	E, A	CA	87.0	8.4	4.6	0.18	0.52	0.14	0.11

I would do extra training at home if I thought this would decrease my risk of LLI	E, A	CA	71.4	17.0	11.6	0.43	<0.01	0.32	0.87
Beliefs about injury outcomes									
Injuries usually do not stop you missing more than one game	A	PSv	28.8	20.4	50.8	0.04	0.62	0.16	0.17
I would stop playing if I got a LLI	I	PBe	30.4	29.5	40.1	0.67	0.46	0.27	0.73
I feel under pressure to continue to play in a game when I am injured	M	PBa	30.3	13.2	56.5	0.04	0.21	0.56	<0.01
Players who continue to play with lower limb injuries are likely to suffer physical problems later in life	M	PSv	70.7	22.5	6.8	<0.001	0.13	0.70	0.39
I would play with a LLI if it meant we got into the finals	M	PBa	87.3	8.6	4.1	<0.01	0.26	<0.01	0.05
Beliefs about injury prevention and training									
Lower limb injuries can be prevented by stricter refereeing in games	R	PBe	10.0	26.4	63.6	0.08	0.79	0.64	<0.001
Attending AFL training prevents lower limb injuries	A	PBe	49.3	32.0	18.7	0.37	0.44	0.55	0.17
Lower limb injuries can be prevented by doing specific training and exercises	E	PBe	74.4	19.9	5.7	0.38	0.99	0.02	0.12

Beliefs about injury risk									
Preventing lower limb injuries is not a large concern for me at my level of play	A	PSu	26.8	17.3	55.8	<0.001	0.80	0.57	0.01
Players don't need to be fully rehabilitated from a LLI before playing AFL again	E	PSv	24.3	19.5	56.2	0.26	0.02	0.01	0.85
Ankle injuries are more common than knee injuries in AFL	R	PSu	29.5	51.2	19.2	0.29	0.64	0.72	0.01
I would be targeted by opposition if I wore visible protective equipment	A	PBa	31.1	29.7	39.2	<0.001	0.97	0.99	0.78
Lower limb injuries in AFL are often caused by foul play	R	NA	11.9	18.4	69.7	<0.001	0.90	0.35	0.08
AFL has a high risk of lower limb injuries	R	PSu	77.7	17.1	5.2	0.08	<0.001	0.42	0.57
Responsibility for injury prevention and source of knowledge									
The coach is in charge of preventing injuries at training sessions	I	SE	13.8	18.2	68.0	0.43	0.82	0.05	0.37
Team coaches/ physiotherapists have taught me what I know about preventing lower limb injuries	I	SE	59.4	16.8	23.8	0.30	0.80	0.15	0.14
Team mates have taught me what I know about preventing lower limb	I	SE	25.9	21.7	52.4	0.17	0.37	0.88	0.03

injuries									
Beliefs about training									
People who train more can play harder	A	PBe	78.4	7.3	14.3	0.01	0.82	0.22	0.02
Players who don't attend training regularly get injured	A	PBe	44.3	36.1	19.6	0.32	0.53	0.52	0.89
Training should focus more on improving game performance than on preventing injuries	R, A	PBa	64.1	18.9	17.0	0.03	0.63	0.59	0.19

1: % of those with valid (non-missing) responses to the question. SA/A=strongly agree/agree. U=uncertain. SD/D=strongly disagree/disagree

2: p values from ordinal logistic regression model (ns=p>0.05).

3: RE-AIM dimensions: R: reach; E: effectiveness; A: adoption; I: implementation; M: maintenance

4: HBM constructs: PSu: perceived susceptibility; PSv: perceived severity; PBe: perceived benefits; PBa: perceived barriers; CA: cues to action; SE: self-efficacy; NA: not applicable (not every question related to a HBM construct).

5: Although the name of the game is Australian Football, in New South Wales where this study was conducted it is more commonly referred to as to Australian Football League and so that terminology was used in the survey

RESULTS

374 male players (median age 23 years [range: 17-38 years]) completed the survey (95% response rate). Most were experienced players with 47.1% having played for >10 seasons and 50% were currently playing in the most senior competition. Almost half of the players (49.2%) reported they had sustained a LLI during the previous playing season.

Table 1 shows the players' responses to the general opinion statements. The players' strongest agreement was with the statement that they would play with a LLI if it meant their team got into the finals. They least agreed that LLIs are caused by foul play. Table 1 also shows the relationship between the 24 belief statement responses and players' characteristics. For nine statements, there was a significant relationship with age; for six statements, there was a significant relationship with competition level; three statements were significantly related to self-reported previous LLI and years of playing experience.

Players were asked if they believed different training program components would improve their football performance LLIP (Table 2). The four training components that >90% of players believed would improve their performance were drills/set-plays, ball handling skills, kicking skills and endurance/fatigue training. In contrast, the only three components that >90% of players supported for LLIP were warm-up run, cool-downs and warm-up stretches. There was a statistically significant difference between the rankings of players' opinions about the benefits for performance and LLIP for all components, except for warm-up run, warm-up stretches and jumping/landing training. These ranking differences were greatest for ball-handling

Table 2. Players' opinions about the importance of a range of training components for improving football performance or for preventing lower limb injuries.

Training component	(Training component) would improve football performance?[1]			(Training component) would prevent lower limb injuries?[1]			Wilcoxan Signed Rank Test	
	SA/A	U	SD/D	SA/A	U	SD/D	|D|[2]	p-value
Ball handling skills	97.0	2.2	0.8	35.4	32.7	31.9	332	<0.001
Drills and set-plays	95.3	3.9	0.8	46.5	34.3	19.1	238	<0.001
Kicking skills	98.9	0.5	0.5	60.4	23.4	16.2	192	<0.001
Sprint sessions	87.7	7.9	4.4	66.9	17.9	15.2	117	<0.001
Endurance/fatigue training	94.0	4.9	1.1	73.4	17.7	8.9	105	<0.001
Wearing protective equipment	40.4	30.6	29.0	55.9	25.9	18.2	95	<0.001
Balance training	55.3	32.0	12.7	69.2	23.9	6.9	69	<0.001
Weights/resistance training	85.5	9.6	4.9	74.6	15.2	10.2	60	<0.001
Cool-downs	81.5	12.0	6.5	91.5	5.2	3.3	47	<0.001
Cutting /stepping training	80.2	14.4	5.4	72.8	17.0	10.2	43	0.001
Warm-up run	88.0	6.5	5.4	91.5	4.9	3.6	18	0.08
Jumping and landing training	66.2	25.6	8.2	71.3	19.1	9.6	11	0.52
Warm-up stretches	88.8	5.4	5.7	90.4	4.4	5.2	6	0.55

1: % of those with valid (non-missing) responses to the question. SA/A=strongly agree/agree. U=uncertain. SD/D=strongly disagree/disagree

2: Absolute value of the sum of differences between football performance and LLIP scores. The greater the value of |D|, the greater the differences between the two.

skills, drills and set-plays and kicking skills, all of which favoured performance over LLIP.

DISCUSSION

This study summarises Australian Football players' attitudes and beliefs around LLIP, particularly the benefits of training. To our knowledge, this is the first sports injury prevention study to apply both HBM constructs associated with a relevant ecological model[2] and the RE-AIM framework to inform the design of a sports injury prevention delivery plan.[15] The information is important because it gives clear guidance for the targeting and delivery of exercise training program specifically for these players.

Overall, surveyed players had an accurate perception of football-related LLI risk, that reflected the reported frequency of LLI in this sport, [32-36] though their relative rankings of knee versus ankle injuries was different to the literature.[32-33 35] These findings support the need for players to be further educated about the risk of knee injury specifically and also suggest that exercise interventions should be marketed as being of a more general LLIP nature rather than just focussing on knee injuries. This has implications for both the RE-AIM reach and adoption components. As most exercise training programs that address knee neuromuscular control are also likely to benefit the rest of the lower limb [22], broadening the focus of intervention programs for targeting purposes would still maintain biomechanical fidelity.

Only about half of all players considered that LLIs could be serious and impact on their ability to play a game, despite published information about this.[37] The majority

appear to recognise the potential for adverse consequences associated with continuing to play with LLIs in terms of the physical implications this may have later in life but there was no strong view about being fully rehabilitated from a LLI before returning to play. This suggests that players need to be better educated about the nature and extent of possible adverse LLI outcomes and that any strategy to recruit them into an RCT and maintain their engagement with exercise training practices should emphasise both LLIP and performance gains. The fact that beliefs about injury risk and injury outcomes was often related to player age and experience, suggests that any overarching approach may need to include different education/promotion strategies for players at different stages of their football career, to make sure that all consider LLIP to be relevant to them. This has particular implications for the adoption and maintenance RE-AIM components.

Most players understood that specific training and exercises have a role in LLIP. This indicates a likely readiness of players to adopt LLIP programs when they are embedded into standard football training sessions. There was a difference in players with/without a previous LLI in regards to views about undertaking additional training at home, indicating that such a delivery strategy would not be adopted by all players. Nonetheless, about a third of players who were uncertain about the LLIP benefits of attending training also indicated a lack of knowledge about specific training components for reducing LLI risk; this is consistent with the level of knowledge exhibited by coaches of the same teams.[7] The only other factor that players believed was more important for LLIP than performance was protective equipment use; this was rated even higher than warming-up, cooling down and balance training, in the absence of formal evidence to support this view.

Players were in strong agreement that most components of training sessions would improve performance and the majority agreed that undertaking specific exercises would led to LLIP. This suggests that extensive efforts aimed at educating players about the benefit of exercises/training programs are unlikely to be needed before footballers were recruited into an exercise training RCT. However, there is still a need to educate players about the benefits of some aspects of training sessions such as skills training, ball handling and jump/landing, as many rate them as being highly important for performance but not for LLIP.

It is concerning that the vast majority of players would contemplate playing with a LLI if it was an important game even though they did not feel under pressure to play when injured, consistent with previous findings in elite junior footballers.[28] This has important implications in terms of preventing injury recurrence and rehabilitation strategies post injury. Whilst players recognise the long-term risk of continuing to play with injury, external factors are likely to make it difficult in reality to convince them to take time away from their sport to fully recover, particularly if they perceive their absence as detrimental to the team's performance; about one-third of players felt under pressure to continue to play in a game when they were injured. Given this, an effective implementation strategy would be delivered whole teams of players, rather than just individual players, so that the benefits to the team can be stressed and peer support could influence the adoption.

"Barriers" have been identified as the most powerful of the HBM components in terms of predicting a whole variety of behaviours.[12] This study highlights important barriers to LLIP that would need to be addressed in the delivery of exercise interventions implemented as part of football training. The majority of players agreed

that training should focus more on improving game performance than on LLIP, and whilst they also have a general belief in the value of exercises for LLIP they do not want this as the major focus of their training sessions completely. This is further complicated by the clear delineation of players' beliefs as to what components of training contribute most to improved performance and which mostly to LLIP. Players are unlikely to be fooled by LLIP marketed as being performance enhancing, if there are no clear performance outcomes. It is advisable, therefore, that LLIP exercises delivered during training are acknowledged as such and have a shorter duration that training components aimed at performance and game development. Given the strong support for warming-up type strategies for LLIP, it would seem appropriate to also place other purely- LLIP training activities towards the start of training sessions.

Although the majority of surveyed players would attend a university to test their skills for LLIP, more would be willing to do so if it helped them to play better. This is important to know because specific recruitment strategies may need to be developed to encourage players to undergo further testing away from their training venue. Similarly, the majority of players would do extra training at home if they thought it would decrease their risk of LLI but even more would do the extra training if they thought it would help them play better. Taken together, this suggests that LLIP is a strong enough stimulus to trigger many players to undertake additional skills testing and extra training. This is good news for LLIP measures that require this kind of behaviour uptake. However, the findings above in relation to team building and overall performance goals of training sessions, and the fact that it is hard to both monitor correct techniques in outside training and to provide the necessary equipment for it to be undertaken, means that delivery of an intervention through

formal football training sessions is likely to be more acceptable to players and to ensure any required behaviours are maintained.

This study does have some limitations that need to be acknowledged. Although a major strength is the fact that the survey was constructed from a theoretical basis deriving from the HBM and RE-AIM, because the questions were not structured to address a single behaviour, it was not possible to formally test the applicability of the HBM or to further explore the particular beliefs according to the theory predictions in detail. Even though the analyses presented here would suggest that the HBM is relevant to understanding beliefs about LLI and LLIP in football players, there would be further value in formally testing the HBM in this context.

The survey was only conducted within participants of Australian Football, and it is not known to what extent the beliefs and cues to action identified in this study would apply to other sports. Similarly, the surveyed footballers were high performance players and it is possible that players at lower levels of competition (e.g. in community clubs) could have different views. Both of these aspects of generalisation of results should be assessed in future studies.

In conclusion, this study has examined players' understanding of the importance of training sessions for improving performance and LLIP. This information was then interpreted within the RE-AIM domains to indicate important considerations for optimal program development and delivery for the subsequent RCT.[8 15] Players generally agree that doing specific exercises would reduce their LLI risk and would be willing to undertake exercises for LLIP, but not at the cost of reducing training time that is perceived to improve their performance. They appear to be largely unaware of the latest evidence on the role of landing and balance training in LLIP,

which is consistent with their coaches.[7] It would seem that the optimal approach would be to deliver exercise training LLIP programs as part of routine football activities, and integrated with those as standard practice, as a means of associating them with training benefits for this sport.

This study has identified important factors that need to be incorporated into the development of delivery plans for implementation in a large RCT of exercise training interventions. Whilst the results from that RCT[27] are not yet available, it is certainly expected that they will have more rigour than some of those from other exercise intervention studies, because issues of intervention uptake and sustainability have been addressed from the outset of the RCT intervention delivery planning phase. It is recommended that designers of future sports injury intervention studies, of whatever type of preventive measure, invest significant time and effort prior to design finalisation to also obtain important information about factors that may impact on the uptake of maintenance of those measures.

ACKNOWLEDGMENTS

Assoc Prof David Lloyd and Prof Bruce Elliott are thanked for their input in the planning stage of this study. Dr Elizabeth Roediger and Ms Maria Romiti conducted the surveys as members of the research team.

COMPETING INTERESTS

None

FUNDING

The data collection phase of this study was funded by a University of New South Wales GoldStar Award. The analysis phase was supported by a nationally-competitive research grant from the (Australian) National Research Council of Australia (NHMRC) (ID: 400937). Prof Caroline Finch was supported by an NHMRC Principal Research Fellowship (ID: 565900) and Dr Dara Twomey/Dr Peta White by the NHMRC Project Grant.

REFERENCES

1. Finch C. A new framework for research leading to sports injury prevention. *J Sci Med Sport* 2006;9(1-2):3-9; discussion 10.
2. Eime R, Owen N, Finch C. Protective eyewear promotion: applying principles of behaviour change in the design of a squash injury prevention programme. *Sports Medicine* 2004;34(10):629-38.
3. Braham R, Finch C. Do community football players wear allocated protective equipment? Descriptive results from a randomised controlled trial. *Journal of Science & Medicine in Sport* 2004;7(2):216-20.
4. Finch C, McIntosh A, McCrory P. What do under 15 year old schoolboy rugby union players think about protective headgear? *British Journal of Sports Medicine* 2001;35:89-94.
5. Eime R, Finch C. Have the attitudes of Australian squash players towards protective eyewear changed over the past decade? *British Journal of Sports Medicine* 2002;26:442-45.
6. Iversen M, Friden C. Pilot study of female high school basketball players' anterior cruciate ligament injury knowledge, attitudes, and practices. *Scandinavian Journal of Medicine & Science in Sports* 2009;19(4):595-602.
7. Twomey D, Finch C, Roediger E, Lloyd D. Preventing lower limb injuries – is the latest evidence being translated into the football field? *Journal of Science & Medicine in Sport* 2009;12(4):452-56.
8. Saunders N, Otago L, Romiti M, Donaldson A, White P, Finch C. Coaches' perspectives on implementing an evidence-informed injury prevention program in junior community netball. *British Journal of Sports Medicine* 2010;BJSM OnLine First. Published online June 11, 2010:doi: 10.1136/bjsm.2009.069039.
9. Bahr R, Krosshaug T. Understanding injury mechanisms: a key component of preventing injuries in sport. *Br J Sports Med* 2005;39(6):324-9.
10. McIntosh A. Risk compensation, motivation, injuries, and biomechanics in competitive sport. *British Journal of Sports Medicine* 2005;39:2 - 3.
11. Gielen AC, Sleet D. Application of behavior-change theories and methods to injury prevention. *Epidemiol Rev* 2003;25:65-76.
12. Janz N, Becker M. The health belief model: A decade later. *Health Education Quarterly* 1984;11:1-47.
13. Trifiletti L, Gielen A, Sleet D, Hopkins K. Behavioral and social sciences theories and models: Are the used in unintentional injury prevention research? *Health Education Research* 2005;20:298-307.

14. Glasgow R, Klesges L, Dzewaltowski D, Estabrooks P, Vogt T. Evaluating the impact of health promotion programs: using the RE-AIM framework to form summary measures for decision making involving complex issues. *Health Education Research* 2006;21(5):688-94.
15. Finch CF, Donaldson A. A sports setting matrix for understanding the implementation context for community sport. *Br J Sports Med* 2010.
16. Glasgow R, Vogt T, Boles S. Evaluating the public health impact of health promotion interventions: the RE-AIM framework. *American Journal of Public Health* 2001;89:1322-27.
17. Engebretsen AH, Myklebust G, Holme I, Engebretsen L, Bahr R. 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(6):1052-60.
18. Crosier J-L, Ganteaume S, Binet J, Genty M, Ferret J-M. Strength imbalances and prevention of hamstring injury in professional soccer players: a prospective study. *American Journal of Sports Medicine* 2008;36:1469-75.
19. Kilding AE, Tunstall H, Kuzmic D. Suitability of FIFA's" The 11" training programme for young football players-impact on physical performance. *Journal of Sports Science and Medicine* 2008;7:320-26.
20. 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. *British Journal of Sports Medicine* 2005;39(6):363-68.
21. Gabbe B, Branson R, Bennell K. A pilot randomised controlled trial of eccentric exercise to prevent hamstring injuries in community-level Australian football. *Journal of Science and Medicine in Sport* 2006;9:103-09.
22. Olsen OE, Myklebust G, Engebretsen L, Holme I, Bahr R. Exercises to prevent lower limb injuries in youth sports: cluster randomised controlled trial. *BMJ* 2005;330(7489):449.
23. Verhagen E, van der Beek A, Twisk J, Bouter L, Bahr R, van Mechelen W. The effect of a proprioceptive balance board training program for the prevention of ankle sprains: a prospective controlled trial. *American Journal of Sports Medicine* 2004;32(6):1385-93.
24. Lloyd D. Rationale for training programs to reduce anterior cruciate ligament injuries in Australian football. *Journal of Orthopaedic & Sports Physical Therapy* 2001;31(11):645-54.
25. Rosenstock I. The health belief model and preventive health behaviour. *Health Education Monographs* 1974;2:354-86.

26. McGlashan A, Finch C. The extent to which behavioural and social sciences theories and models are used in sport injury prevention research. *Sports Medicine* 2010;In press.
27. Finch C, Lloyd D, Elliott B. The Preventing Australian Football Injuries with eXercise (PAFIX) study - a group randomised controlled trial. *Injury Prevention* 2009;15(e1).
28. Finch C, Donohue, Garnham A. Safety attitudes and beliefs of junior Australian football players. *Injury Prevention* 2002;8(2):151-54.
29. A language and environment for statistical computing. [program]. Vienna, Austraia: R Foundation for Statistical Computing. Available at: http://www.R-project.org 2004.
30. Hosmer D, Lemeshow S. *Applied logistic regression.* 2nd ed: Wiley, 2000.
31. Corder G, Foreman D. *Nonparametric statistics for non-statisticians: A step-by-step approach.*: Wiley, 2009.
32. Braham R, Finch C, McIntosh A, McCrory P. Community level Australian football: a profile of injuries. *Journal of Science and Medicine in Sport* 2004;7(1):96-105.
33. Gabbe B, Finch C, Wajswelner H, Bennell K. Australian football: injury profile at the community-level. *Journal of Science and Medicine in Sport* 2002;5(2):149-60.
34. Gabbe B, Finch C, Wasjswelner H, Bennell K. Predictors of lower extremity injuries at the community level of Australian football. *Clinical Journal of Sports Medicine* 2004;14:56-63.
35. McManus A, Stevenson M, Finch CF, Elliott B, Hamer P, Lower A, et al. Incidence and risk factors for injury in non-elite Australian Football. *J Sci Med Sport* 2004;7(3):384-91.
36. Orchard J, Seward H. Epidemiology of injuries in the Australian Football League, seasons 1997-2000. *Br J Sports Med* 2002;36(1):39-44.
37. Orchard J, Seward H. Injury Report 2008 Australian Football League. *Available from www.injuryupdate.com.au* 2009;20th May 2009.:1-15.