

Countrywide Campaign to Prevent Soccer Injuries in Swiss Amateur Players

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Background: In Switzerland, the national accident insurance company registered a total of 42 262 soccer injuries, resulting in costs of approximately 145 million Swiss francs (~US\$130 million) in 2003. Research on injury prevention has shown that exercise-based programs can reduce the incidence of soccer injuries.

Purpose: This study was conducted to assess the implementation and effects of a countrywide campaign to reduce the incidence of soccer injuries in Swiss amateur players.

Study Design: Cohort study; Level of evidence, 3.

Methods: All coaches of the Schweizerischer Fussballverband (SFV) received information material and were instructed to implement the injury prevention program “The 11” in their training of amateur players. After the instruction, the coaches were asked to rate the quality and the feasibility of “The 11.” Before the start of the intervention and 4 years later, a representative sample of about 1000 Swiss soccer coaches were interviewed about the frequency and characteristics of injuries in their teams. Teams that did or did not practice “The 11” were compared with respect to the incidence of soccer injuries.

Results: A total of 5549 coaches for amateur players were instructed to perform “The 11” in the training with their teams. The ratings of the teaching session and the prevention program were overall very positive. In 2008, 80% of all SFV coaches knew the prevention campaign “The 11” and 57% performed the program or most parts of it. Teams performing “The 11” had an 11.5% lower incidence of match injuries and a 25.3% lower incidence of training injuries than other teams; noncontact injuries in particular were prevented by the program.

Conclusion: “The 11” was successfully implemented in a countrywide campaign and proved effective in reducing soccer injuries in amateur players. An effect of the prevention program was also observed in the population-based insurance data and health-care costs.

Keywords: soccer; injury; prevention; countrywide campaign

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One or more of the authors has declared a potential conflict of interest: Markus Lamprecht and Hanspeter Stamm are working for Lamprecht & Stamm, Sozialforschung und Beratung AG, Zurich. This company was contracted by Schweizerische Unfallversicherungsanstalt (SUVA) to independently evaluate the implementation and effects of the prevention program. However, neither the methods nor the results were influenced in any way by SUVA. Chris Chilvers and Heinz Wyss are employees of SUVA, but they were not involved in the implementation and evaluation.

The “big count” in 2006 of the Fédération Internationale de Football Association (FIFA) revealed that 265 million people play soccer worldwide (www.fifa.com). In Switzerland, the national soccer association (Schweizerischer Fussballverband [SFV]) registered 226 000 licensed players, and it is estimated that 600 000 people play soccer at least occasionally. Based on the data of the national accident insurance company (Schweizerische Unfallversicherungsanstalt [SUVA]), a total of 42 262 soccer injuries were incurred while playing soccer, which resulted in costs of approximately 145 million Swiss francs (~US\$130 million) and the loss of more than 500 000 working days in 2003 (www.unfallstatistik.ch). Facing the frequency of injury, the resulting primary and secondary costs, and not least the personal suffering of the injured players, prevention programs needed to be developed and implemented for this large group of the population.

Before the start of the project in 2004, the frequency and characteristics of soccer injuries had been described in the literature but only a few studies had been conducted regarding the effectiveness of prevention programs.²⁰ Some studies had focused on the prevention of soccer

TABLE 1
Rating of the Coaches (N = 3265) After the Instruction of "The 11" and Reception of the Material

Rating Elements	Mean (Standard Deviation)
Rating of the course ^a	
"The 11" was explained in a comprehensive and understandable way.	4.4 (0.66)
We received the information material (DVD, booklet) and studied it.	4.7 (0.60)
All exercises of "The 11" were explained and performed.	4.6 (0.72)
We performed the exercises ourselves and were corrected doing it.	4.3 (0.90)
I know all exercises and can instruct them without any difficulties.	4.1 (0.80)
Some exercises of "The 11" are already part of my training.	3.4 (1.27)
I will try some exercises of "The 11" in the training of my team.	4.3 (0.73)
I will perform "The 11" regularly in the training of my players.	4.0 (0.86)
I think my players will perform the exercises long-term.	3.9 (0.83)
Rating of the prevention campaign "The 11" ^b	
Idea of the prevention program	4.5 (0.64)
Exercises of "The 11"	4.2 (0.66)
Design of the material (DVD, booklet, poster)	4.4 (0.65)
Practicability in training	4.1 (0.74)
Effect for injury prevention	4.3 (0.69)
Effect on competition (improvement of performance)	4.0 (0.75)
How well do you know the Fair Play promotion of the SFV ^c ?	4.1 (0.83)

^a1 = does not apply at all; 2 = applies a bit; 3 = applies partly; 4 = applies mostly; 5 = applies completely.

^b1 = poor; 2 = not sufficient; 3 = sufficient; 4 = well; 5 = very well.

^cSFV, Schweizerischer Fussballverband (national soccer association).

injuries in general, while others had evaluated the prevention of specific types of injury, namely ankle sprains, severe injuries of the knee, and hamstring strains. In summary, there was good evidence that intervention programs can reduce the incidence of soccer injuries. However, all these studies were performed in a research setting with intervention groups of fewer than 200 people.^{††} Publications on the effects of sports injury prevention on a large scale, such as a countrywide campaign, could not be found in the scientific literature. Thus, the joint project of the FIFA–Medical Assessment and Research Centre (F-MARC), SUVA, and SFV aimed not only at the countrywide implementation of a prevention program for soccer injury to reduce its incidence by 10% but also on the independent scientific evaluation of the implementation process and the effects of the prevention program on Swiss amateur soccer players aged 14 to 65 years.

METHODS

The Prevention Program "The 11"

"The 11" is a simple and catchy injury prevention program for amateur soccer players that includes 10 evidence-based or best-practice exercises and the promotion of Fair Play (see the online Appendix for this article, available at <http://ajs.sagepub.com/supplemental/>). "The 11" program was developed in cooperation with national and international experts under the leadership of F-MARC to reduce the most frequent and most severe types of soccer injury,

such as ankle sprains, hamstring and groin strains, and ligament injuries in the knee.⁷ Its conduction requires no equipment other than a ball, can be completed in 10 to 15 minutes, and should be performed in every training session. The program is described in detail on a DVD and in a booklet, and summarized on a poster (see online Appendix for this article at <http://ajs.sagepub.com/supplemental/>). The booklet and poster can be downloaded from www.fifa.com/medical; the material is available in English, German, French, Italian, and Spanish.

Implementation of "The 11" and Process Evaluation

In Switzerland, all licensed coaches have to complete a basic education and participate in a refresher course every second year. Thus, the instruction of "The 11" was integrated into the coach education of the SFV. First, all instructors of the SFV were educated by a sports physiotherapist in fall 2004 on how to instruct the coaches to implement the prevention program in their soccer training. Subsequently, these instructors educated all coaches in the basic and refresher courses, which took approximately 2 years. During the course, the coaches received information material on "The 11" (DVD, booklet, poster) and were instructed how to correctly perform the exercises. They were to perform the exercises themselves and be corrected by the instructors. At the end of the session, they were asked to rate different aspects of the course and the prevention program on a 5-point Likert scale (see Table 1). In addition to the exercise part of the program, SFV and SUVA launched a "Fair Play Trophy" (go to www.football.ch/sfv/de/Fairplay-Trophy.aspx).

^{††}References 4, 5, 8, 16, 17, 21, 25, 28, 29.

Evaluation of the Effects

Before the start of the intervention (May 2004) and 4 years later (May 2008), a representative sample of Swiss amateur coaches was interviewed about the frequency and characteristics of injuries in their teams. In the postintervention interviews, they were also asked about their knowledge and implementation of "The 11." Coaches of the national team, the Super and Challenge League, the first and second inter-regional leagues, and of teams for players younger than 14 years of age were excluded from the study. If a coach trained more than 1 team, he or she was asked to relate the answers to the team the coach knew best. It was intended to include as many coaches as possible in both surveys but also expected that approximately half of them would not be available for the second interview and would need to be replaced to reach the intended sample size.

A computer-assisted, fully structured telephone interview was developed regarding the recent consensus statement on the definition and data collection procedures¹¹ and pilot-tested. The preintervention interview primarily focused on the frequency and characteristics of training, matches, and injuries. The postintervention interview also covered knowledge of the prevention program and details on its implementation. Almost all questions had predefined answers and some required a number. For most questions, the answer choices were provided and for some questions the interviewers categorized the answers of the coaches. The interviewers gave definitions of certain variables (for details, see Fuller et al¹¹) and were instructed on how to categorize the responses. To improve the accuracy of injury reports, coaches were first instructed to recall the last match (eg, their opponent) and then asked to report the related injuries. For each injury mentioned, they were asked about the location, type, mechanism (contact, foul play) and consequences (time loss, medical attention). The interviewer then asked the coach to recall the match before the last match and to report the related injuries, and repeated this procedure for all matches in the previous 4 weeks, and finally the interviewer asked the coach about training injuries in the same period of time. The interviews were conducted by a specialized institute (LINK Institute, Luzern) in German and French to cover the 2 languages most commonly spoken in Switzerland. The average duration of the preinterviews was 12 minutes, and of the postinterviews 20 minutes.

Statistical Analysis

Statistical methods applied were frequencies, means, cross-tabulations, and the χ^2 test. Significance was accepted at $P < .05$. Injury incidences were calculated separately for training and match injuries,¹¹ and 95% confidence intervals were calculated as the incidence ± 1.96 times the incidence divided by the square root of the number of injuries. For analysis of intervention effects, teams were divided into those that "currently perform The 11" and those that did not, based on the coach's response to the respective question.

RESULTS

Selection of Sample for Outcome Evaluation

In 2004, the SFV provided a complete list of all 5384 licensed amateur coaches from which a representative random sample of 1574 was selected. About one-third of the coaches ($n = 545$) could not be included in the survey, mainly because they were no longer training an amateur team ($n = 238$) or they were not reachable by phone ($n = 222$); 40 coaches refused to be interviewed. Of the 1027 coaches interviewed before the intervention, 310 (30.1%) were also interviewed postintervention, 381 (37.0%) were no longer coaching a soccer team, and 338 (32.8%) were not interviewed for other reasons. Thus, a second random sample of 1015 coaches was drawn from a new list of SFV coaches in 2008. Of this group, 705 (69.3%) coaches were interviewed, and the remaining were again mainly no longer training an amateur team ($n = 151$) or not reachable by phone ($n = 80$); 47 coaches refused to be interviewed.

Characteristics of the Coaches and Their Teams

Almost all coaches were male, and the majority were from German-speaking parts of Switzerland (for details see Appendix 2 in the online Appendix for this article at <http://ajs.sagepub.com/supplemental/>). On average, the coaches were 40 years of age and had coached soccer teams for about 10 years. The average team consisted of 19 players, of whom 14 usually participated in a training session. The teams trained on average twice a week for 90 minutes and played 1 match per week. The characteristics of coaches and teams were similar in 2004 and 2008, except for the number of coaches without a license, but several statistically significant differences were observed attributable to the large sample sizes (see Appendix 2). No substantial differences were observed between the coaches who took part versus those who did not take part in the preintervention interviews.

Injury Profile Before the Intervention

The coaches reported that 1471 soccer injuries (1.18 per team) occurred in the 4 weeks before the preintervention interviews and consequently, 1218 players did not fully participate in the last training session before the interview. The majority of injuries occurred during matches (72%) and affected the lower extremities (85%). The most frequent types of injuries were thigh strains and ankle sprains. Only 12% of the reported injuries did not result in time loss in training or matches. In 28% of the injuries, the time loss was up to 1 week, and in about 20% each the time loss was 8 to 14 days, 15 to 28 days, and >4 weeks (see Table 2). In almost 40% of the injuries, the player visited a physician. About 70% of the injuries were incurred without contact to another player. Injuries in training and matches were similar with respect to type and location, but match injuries were slightly more severe (medical attention, time loss) and more often caused by players'

TABLE 2
Incidence of Match and Training Injuries (per 1000 Hours of the Respective Exposure) in the Previous 4 Weeks

	Match			Training		
	2004	2008 and Did "The 11"	2008 and Not "The 11"	2004	2008 and Did "The 11"	2008 and Not "The 11"
No. of injuries	1054	495	419	417	224	179
Total incidence of injuries	15.15	12.55	14.18	2.44	1.98	2.65
Teams						
Male 2nd and 3rd leagues	16.24	13.52	15.09	2.63	2.18	1.95
Male 4th and 5th leagues	17.09	16.91	16.12	2.65	2.75	3.39
Male 16-18 years	12.18	11.70	12.79	2.18	1.71	2.16
Male 14-15 years	10.06	8.30	8.97	1.68	1.35	1.31
Male seniors	22.67	16.48	18.42	4.87	5.64	6.06
Female, all levels	13.76	12.36	10.42	1.13	1.35	1.90
Medical attention	5.94	5.82	5.82	0.84	0.76	0.99
Time loss						
No days	1.87	1.03	1.52	0.26	0.26	0.27
1-7 days	4.30	3.66	2.87	0.77	0.65	0.72
8-28 days	6.11	5.40	6.91	1.04	0.80	1.09
>28 days	2.71	2.40	2.69	0.37	0.26	0.57
Had to stop soccer	0.10	0.05	0.18	0.00	0.00	0.00
Mechanism						
Contact	4.67	4.85	3.76	0.57	0.48	0.46
Noncontact	10.30	7.45	10.18	1.87	1.49	2.18
Location						
Groin	1.39	0.30	0.34	0.23	0.12	0.22
Thigh	3.52	2.73	3.22	0.57	0.54	0.57
Knee	2.12	1.76	2.07	0.28	0.23	0.39
Lower leg/Achilles tendon	1.39	0.91	1.35	0.18	0.13	0.24
Ankle	3.52	3.58	3.73	0.64	0.61	0.74
Others, do not know	3.33	3.21	3.47	0.55	0.34	0.49
Type						
Contusion	4.00	3.21	2.98	0.50	0.48	0.33
Ligament injury, sprain luxation	3.58	3.70	3.69	0.71	0.56	0.84
Strain	4.48	2.48	3.73	0.67	0.55	0.84
Fracture	0.55	0.61	0.71	0.08	0.04	0.06
Others, do not know	2.61	2.55	3.05	0.49	0.34	0.58

contact. About half of the contact injuries in matches were the result of foul play. The incidence of injuries differed significantly between teams of different age, gender, and level of play. For further details, see Table 2.

Education of Coaches and Their Rating of the Campaign

From 2005 to 2007, a total of 5549 coaches participating in 145 courses assessed the instruction of "The 11" and the prevention program itself. More than half of these coaches trained either adults (n = 1451; 26.1%) or junior players older than 14 years (n = 1814; 32.7%) who were the target population of the intervention. The detailed results of the target group are presented in Table 1. The ratings of the teaching session and the prevention program were overall very positive. The exercises were in general not already part of the training and most coaches felt prepared to implement the exercises in the training with their teams.

Knowledge and Performance of "The 11"

In 2008, 79.8% of all interviewed coaches knew "The 11," and 57% stated they currently performed the program or a selection of the exercises with their team. About half of the coaches who did not do "The 11" with their team did not know the program. Other main reasons for not performing "The 11" were "doing similar exercises," "not having enough time," or "other priorities." Coaches who did "The 11" instructed on average 3.7 exercises for a mean duration of 13 minutes mostly once (59.3%) or twice (33.0%) a week. The majority of coaches varied the selected exercises, and 57.4% performed "The 11" for more than 6 months. Almost all coaches (98%) paid attention to the correct performance of the exercises. "The 11" was performed as part of the warm-up; however, average duration of the warm-up (about 20 minutes) did not change substantially between 2004 and 2008.

Coaches who did and did not implement "The 11" were similar in age, gender, and number of players on the team

and duration of training, but a high percentage of the coaches who did not implement “The 11” (20.1%) had no coaching license. In addition, the prevention program was performed by a low proportion of male senior teams (20.4%), although this group had the highest incidence of injury in the present study (see Appendix 2 in the online Appendix for this article at <http://ajs.sagepub.com/supplemental/> and Table 2).

Effects of “The 11”

In 2008, teams performing “The 11” had an 11.5% lower incidence of match injuries in the last 4 weeks (12.6; 95% confidence interval [CI], 11.5-13.7) than other teams (14.2; 95% CI, 12.8-15.6), and a 17.2% lower incidence compared with 2004 (15.2; 95% CI, 14.3-16.1). Noncontact injuries in particular were reduced by the prevention program: teams performing “The 11” (7.45; 95% CI, 6.6-8.3) had a 27% lower incidence of noncontact match injuries than teams not doing “The 11” (10.2; 95% CI, 9.0-11.3). Other differences between the groups were mainly in the same direction but did not reach statistical significance because of the small sample size (see Table 2).

The incidence of training injuries in the last 4 weeks decreased from 2004 (2.44; 95% CI, 2.21-2.67) to 2008 by 18.9% in teams that performed “The 11” (1.98; 95% CI, 1.72-2.24) but it increased by 8.6% in teams not doing “The 11” (2.65; 95% CI, 2.26-3.04). Thus in 2008, teams performing “The 11” had a 25.3% lower incidence of training injuries than the other teams. Significant differences between the groups were also observed for training injuries that were incurred without contact to another player (1.49; 95% CI, 1.26-1.72 vs 2.18; 95% CI, 1.83-2.53) and those that resulted in time loss (1.72; 95% CI, 1.47-1.97 vs 2.38; 95% CI, 2.00-2.76). Almost all other differences were in the same direction but did not reach statistical significance because of the small sample size (see Table 2).

The proportion of players who did not participate in the last training session because of soccer injury was significantly lower in teams doing “The 11” ($n = 653$ [7.8%]) than in the other teams ($n = 578$ [9.7%]); $\chi^2 = 13.4$; $P < .001$) (Figure 1). Compared with 2004, teams performing “The 11” had 10% fewer players missing the last training due to an injury ($\chi^2 = 4.8$; $P < .05$), while the percentage increased by 11.3% from 2004 to 2008 in teams not doing “The 11” ($\chi^2 = 4.1$; $P < .05$).

DISCUSSION

This is the first population-based study assessing the effects of a countrywide implementation of a program to reduce soccer injury in amateur players. In a cooperation of the national accident insurance company, the national soccer association, and F-MARC, almost all licensed coaches of SFV were instructed to perform the injury prevention program “The 11” in the training of their teams. An independent research group evaluated the implementation and its effects comparing preintervention and postintervention

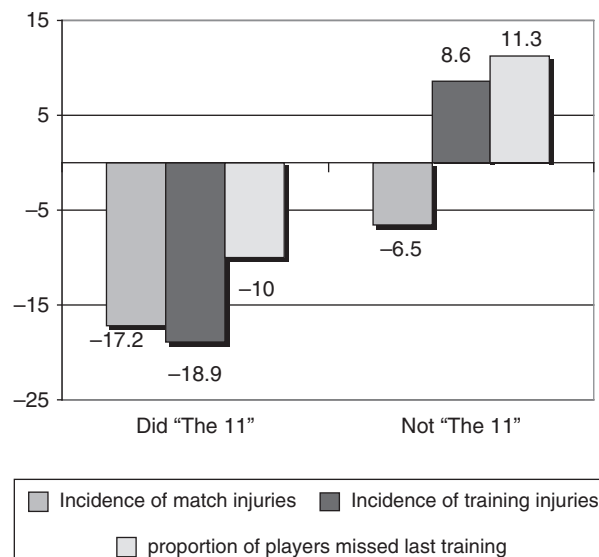


Figure 1. Percentage of change from 2004 to 2008 in the incidence of injuries and in proportion of players missing the last training because of an injury in teams that performed (Did “The 11”) or did not perform “The 11” (Not “The 11”).

information from a representative sample of coaches. The target population was male and female players older than 14 years of all levels of play below the first league. The average team consisted of 19 players, trained twice a week for 90 minutes, and played 1 match per week.

At baseline, the average incidences of match and training injuries were similar to those reported for low-level players^{1,10,19,24} but lower than in elite male players.^{3,9,13,14} In accordance with the literature,²⁰ the average injury incidence was lower in female players than in male players and in adolescents was lower than in adults. The highest incidence was observed in senior players, which is in agreement with the observation that the injury risk increases with age.^{3,6} The location and type of injury was typical for soccer injuries.^{6,15,18} In the present study, 70% of the injuries were incurred without contact to another player. This proportion is higher than in professional soccer,^{2,15} and an important condition for the usefulness of an exercise-based prevention program. On the other hand, about half the contact injuries in matches were the result of foul play. This percentage was lower than reported from professional players,^{30,31} and underlines the importance of the promotion of fair play in amateur players.

After the teaching session on “The 11,” the coaches rated various aspects of the prevention program “The 11” (eg, choice of exercises, practicability in training, effect for prevention) very positive, and the great majority were confident to perform “The 11” regularly with their teams. This is in contrast to a previous study in which coaches showed a low motivation and compliance to perform the prevention program,²⁷ probably because the coaches were less thoroughly instructed. One to 3 years later, about 80% of the representative sample of SFV coaches knew the program, and 57% stated they currently perform the

program or a selection of the exercises with their team. Thus, the implementation in the present study was successful, although the compliance should be further improved. On average, coaches instructed only 40% of the original exercises (but in addition similar exercises) per training session and less than half the teams performed the exercises twice or more often per week. A specific analysis of a subgroup (23.3%) with the highest compliance showed similar effects on injuries. We assume that the proper execution of the exercises is more decisive for the prevention effect than the selection of a specific exercise as there are several exercises to train the same aspect. However, male senior teams should receive particular support because these teams had the lowest compliance (only 20% of the teams performed "The 11") and the highest incidence of injury.

In the present study, teams performing "The 11" had significantly fewer training and match injuries than teams who did not implement the exercises. This is in agreement with several other controlled randomized intervention studies demonstrating that prevention programs reduce the incidence of soccer injuries.^{12,20,22,23,26} In a previous study on "The 11," the compliance in the intervention group was too low, so that the program did not influence the injury rate.²⁷ In the present study, performing "The 11" significantly decreased match injuries by 12% and training injuries by 25%, while a randomized controlled study²⁶ on the advanced version of the program "The 11+" demonstrated a reduction of injuries by on average 34%. This difference might be influenced partly by differences in the 2 programs and in the study groups, partly by the fact that the compliance in "The 11+" study was better. With respect to compliance and effect size, it should be kept in mind that the present study aimed at the country-wide implementation of "The 11," while "The 11+" study was strictly controlled and all teams received individual support.

A methodological weakness associated with the design of the project is that the coaches decided whether or not they performed "The 11" with their team, and so differences in their characteristics or training could have influenced the occurrence of injury in their players. A comparison between the groups (see Appendix 2 in the online Appendix for this article at <http://ajs.sagepub.com/supplemental/>) showed that the coaches who did not implement the program had less frequently a coaching license and trained more often senior teams. However, senior teams also had a lower rate of injuries when performing "The 11." All information was collected by interviews with the coaches, which might be associated with memory effects and reporting bias. The coaches were asked before (May 2004) and after the intervention (May 2008) to report all injuries in the previous 4 weeks. Detailed analysis showed a moderate memory effect (decreasing number of injuries with time since the match) but this effect was similar in both years. To minimize any bias of performing the intervention program on the injury reporting, the preintervention and the postintervention interview started with identical questions on team characteristics and injuries.

The coaches were then questioned about prevention in general, and 90% stated they include some kind of preventive interventions in their training. Asked for the kind of intervention in 2008, only 26% of the coaches named "The 11" spontaneously, but 70% listed warm-up and 50% noted stretching. Thus, it is very unlikely that performing "The 11" had biased the coaches' injury reports.

In addition, the Swiss accident insurance registered about 43 022 soccer injuries with resulting costs of 147.6 million Swiss francs in 2007 (www.unfallstatistik.ch), which is an increase of 1.7% compared with 2003. In the same time, however, the number of players registered in the SFV increased by almost 10% (www.football.ch). Thus, an effect of the prevention program was also observed in the population-based insurance data and health-care costs. In conclusion, the prevention program "The 11" was successfully implemented in a countrywide campaign and proved effective in reducing soccer injuries in amateur players.

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REFERENCES

1. Agel J, Evans TA, Dick R, Putukian M, Marshall SW. Descriptive epidemiology of collegiate men's soccer injuries: National Collegiate Athletic Association Injury Surveillance System, 1988-1989 through 2002-2003. *J Athl Train.* 2007;42(2):270-277.
2. Arnason A, Gudmundsson A, Dahl HA, Johannsson E. Soccer injuries in Iceland. *Scand J Med Sci Sports.* 1996;6(1):40-45.
3. Arnason A, Sigurdsson SB, Gudmundsson A, Holme I, Engebretsen L, Bahr R. Risk factors for injuries in football. *Am J Sports Med.* 2004;32(1 Suppl):5S-16S.
4. Asklung C, Karlsson J, Thorstensson A. Hamstring injury occurrence in elite soccer players after preseason strength training with eccentric overload. *Scand J Med Sci Sports.* 2003;13(4):244-250.
5. Caraffa A, Cerulli G, Progetti M, Aisa G, Rizzo A. Prevention of anterior cruciate ligament injuries in soccer: a prospective controlled study of proprioceptive training. *Knee Surg Sports Traumatol Arthrosc.* 1996;4(1):19-21.
6. Dvorak J, Junge A. Football injuries and physical symptoms: a review of the literature. *Am J Sports Med.* 2000;28(5 Suppl):S3-S9.
7. Dvorak J, Junge A, eds. *Football Medicine Manual.* Zurich: FIFA; 2005.
8. Ekstrand J, Gillquist J. Soccer injuries and their mechanisms: a prospective study. *Med Sci Sports Exerc.* 1983;15(3):267-270.
9. Ekstrand J, Timpka T, Hagglund M. Risk of injury in elite football played on artificial turf versus natural grass: a prospective two-cohort study. *Br J Sports Med.* 2006;40(12):975-980.
10. Ekstrand J, Tropp H. The incidence of ankle sprains in soccer. *Foot Ankle.* 1990;11(1):41-44.

11. Fuller CW, Ekstrand J, Junge A, et al. Consensus statement on injury definitions and data collection procedures in studies of football (soccer) injuries. *Clin J Sport Med.* 2006;16(2):97-106.
12. Gilchrist J, Mandelbaum BR, Melancon H, et al. A randomized controlled trial to prevent non-contact anterior cruciate ligament injury in female collegiate soccer players. *Am J Sports Med.* 2008;36(8):1476-1483.
13. Hagglund M, Walden M, Ekstrand J. Previous injury as a risk factor for injury in elite football: a prospective study over two consecutive seasons. *Br J Sports Med.* 2006;40(9):767-772.
14. Hawkins RD, Fuller CW. A prospective epidemiological study of injuries in four English professional football clubs. *Br J Sports Med.* 1999;33(3):196-203.
15. Hawkins RD, Hulse MA, Wilkinson C, Hodson A, Gibson M. The association football medical research programme: an audit of injuries in professional football. *Br J Sports Med.* 2001;35(1):43-47.
16. Heidt RS Jr, Sweeterman LM, Carlonas RL, Traub JA, Tekulve FX. Avoidance of soccer injuries with preseason conditioning. *Am J Sports Med.* 2000;28(5):659-662.
17. Hewett TE, Lindenfeld TN, Riccobene JV, Noyes FR. The effect of neuromuscular training on the incidence of knee injury in female athletes: a prospective study. *Am J Sports Med.* 1999;27(6):699-706.
18. Inklaar H. Soccer injuries: I, incidence and severity. *Sports Med.* 1994;18(1):55-73.
19. Inklaar H, Bol E, Schmikli SL, Mosterd WL. Injuries in male soccer players: team risk analysis. *Int J Sports Med.* 1996;17(3):229-234.
20. Junge A, Dvorak J. Soccer injuries: a review on incidence and prevention. *Sports Med.* 2004;34(13):929-938.
21. Junge A, Rosch D, Peterson L, Graf-Baumann T, Dvorak J. Prevention of soccer injuries: a prospective intervention study in youth amateur players. *Am J Sports Med.* 2002;30(5):652-659.
22. Kiani A, Hellquist E, Ahlqvist K, Gedeberg R, Michaëlsson K, Byberg L. Prevention of soccer-related knee injuries in teenaged girls. *Arch Intern Med.* 2010;170(1):43-49.
23. Mandelbaum BR, Silvers HJ, Watanabe DS, et al. Effectiveness of a neuromuscular and proprioceptive training program in preventing anterior cruciate ligament injuries in female athletes. *Am J Sports Med.* 2005;33:1003-1010.
24. Nielsen AB, Yde J. Epidemiology and traumatology of injuries in soccer. *Am J Sports Med.* 1989;17(6):803-807.
25. Soderman K, Werner S, Pietila T, Engstrom B, Alfredson H. Balance board training: prevention of traumatic injuries of the lower extremities in female soccer players? A prospective randomized intervention study. *Knee Surg Sports Traumatol Arthrosc.* 2000;8(6):356-363.
26. Soligard T, Myklebust G, Steffen K, et al. Comprehensive warm-up programme to prevent injuries in female youth football—a cluster randomised controlled trial. *BMJ.* 2008;337:a2469.
27. Steffen K, Myklebust G, Olsen OE, Holme I, Bahr R. Preventing injuries in female youth football—a cluster-randomized controlled trial. *Scand J Med Sci Sports.* 2008;18(5):605-614.
28. Surve I, Schwellnus MP, Noakes T, Lombard C. A fivefold reduction in the incidence of recurrent ankle sprains in soccer players using the Sport-Stirrup orthosis. *Am J Sports Med.* 1994;22(5):601-606.
29. Tropp H, Askling C, Gillquist J. Prevention of ankle sprains. *Am J Sports Med.* 1985;13(4):259-262.
30. Walden M, Hagglund M, Ekstrand J. Injuries in Swedish elite football—a prospective study on injury definitions, risk for injury and injury pattern during 2001. *Scand J Med Sci Sports.* 2005;15(2):118-125.
31. Walden M, Hagglund M, Ekstrand J. UEFA Champions League study: a prospective study of injuries in professional football during the 2001-2002 season. *Br J Sports Med.* 2005;39(8):542-546.