

Lower Injury Rates for Newcomers to Professional Soccer: a Prospective Cohort Study over Nine Consecutive Seasons

Karolina Kristenson, Markus Waldén, Jan Ekstrand and Martin Hägglund

Linköping University Post Print



N.B.: When citing this work, cite the original article.

Original Publication:

Karolina Kristenson, Markus Waldén, Jan Ekstrand and Martin Hägglund: Lower Injury Rates for Newcomers to Professional Soccer: a Prospective Cohort Study over Nine Consecutive Seasons, 2013, American Journal of Sports Medicine, (41), 6, 1419-1425.

<http://dx.doi.org/DOI: 10.1177/0363546513485358>

Copyright: SAGE Publications (UK and US): No SAGE Choice

<http://www.uk.sagepub.com/home.nav>

Postprint available at: Linköping University Electronic Press

<http://urn.kb.se/resolve?urn=urn:nbn:se:liu:diva-103813>

Lower Injury Rates for Newcomers to Professional Soccer: a Prospective Cohort Study over Nine Consecutive Seasons

Karolina Kristenson, MD^{1,3}; Markus Waldén, MD, PhD^{1,3}; Jan Ekstrand, MD, PhD^{1,3};
Martin Hägglund, PT, PhD^{2,3}.

¹ Department of Medical and Health Sciences, Division of Community Medicine, Linköping University, Sweden.

² Department of Medical and Health Sciences, Division of Physiotherapy, Linköping University, Sweden.

³ Football Research Group, Linköping University, Sweden.

Correspondence should be addressed to:

Karolina Kristenson

Department of Medical and Health Sciences

Linköping University

SE-581 83 LINKÖPING

SWEDEN

Tel: +46 739 414156

E-mail: karolina.kristensson@liu.se

ABSTRACT

Background

No study has investigated whether newcomers to professional soccer have a different injury rate than established players.

Purpose

The primary objective was to investigate whether being a newcomer to professional soccer influences injury rates. The secondary objective was to evaluate whether playing position and player age influence injury rates.

Study Design

Cohort Study; Level of evidence, 2.

Methods

Twenty-six soccer clubs, with 1401 players, were followed prospectively over nine consecutive seasons between 2001 and 2010. Club medical staff recorded time-loss injuries and soccer exposure on an individual level. Cox regression analyses were used to evaluate associations between time-loss injuries and time in professional soccer, playing position, and age.

Results

In total, 6140 injuries and 797,389 hours exposure were registered. A decreased general injury rate was observed for newcomers (n=116) compared with established players (n=3091) (hazard ratio (HR) 0.77; 95% confidence interval (CI) 0.61-0.99). In contrast, newcomers had a higher rate of fractures (rate ratio 1.77, 95% CI 1.05-2.97), especially stress-related bone injuries (rate ratio 2.68, 95% CI 1.08-6.69). Using goalkeepers as reference, all outfield playing positions had significantly higher adjusted injury rates: defenders HR 1.91 (95% CI 1.64-2.24), midfielders HR 1.78 (95% CI 1.53-2.07), and forwards HR 1.82 (95% CI 1.55-

2.14). Using players ≤ 21 years old as reference, the overall adjusted injury rate increased with age, with a peak injury rate among players 29-30 years old (HR 1.44; 95% CI 1.24-1.68).

Conclusion

Newcomers to professional soccer had a lower general injury rate than established players, but a higher rate of stress-related bone injuries. Being a goalkeeper was associated with lower injury rates than all outfield playing positions. Injury rates increased with age, a pattern that persisted after adjusting for playing position and match exposure.

Key Terms: age, football, playing position, risk factor.

What is known about the subject:

No study has previously investigated whether newcomers to professional soccer have a different injury rate than established players. Previous studies have reported conflicting results regarding playing position and age as potential risk factors for injury in male professional soccer.

What this study adds to existing knowledge:

Newcomers were found to have a lower injury rate compared to established players. Goalkeepers had a lower injury rate than outfield players. Injury rates increased with age, a pattern that persisted after adjusting for playing position and match exposure.

INTRODUCTION

Many studies have been published on internal and external risk factors for injury in male elite soccer.¹⁹ Players who are promoted from youth academies are exposed to several factors that may influence injury occurrence, such as physical adaptation to new training methods, changes in training and match loads, lack of social support, and new relationships with players, coaches, technical staff, and medical staff. However, to the authors' knowledge, no previous study has investigated whether newcomers to professional soccer have a different injury rate than their team colleagues.

Age and playing position are two risk factors for injury that have been evaluated previously in the literature, with conflicting results. Some studies detected increased injury rates in older players,⁵ while others reported no association between age and injury rates.^{15,18} Similarly, some studies showed no difference in injury rates between playing positions,^{7,8,18} while others found an increased injury rate for midfielders^{1,4} or forwards,² and lower injury rates among goalkeepers.^{3,4} Inclusion of individual exposure to training and match play in the analyses is less common, and studies have often used different cutoffs for age categorization,^{5,15} two factors that may contribute to the contradictory findings regarding the association between age and injury rates in professional soccer. Studies addressing playing position and injury rate are also limited by a lack of individual exposure registration, and many of them have small samples or have included match injuries only.^{1,2,4} In addition, any concomitant influence of player age and playing position on injury rates is not known, even though the age distribution often differs between playing positions.⁶

The primary objective of this study was to investigate whether being a newcomer to professional soccer influences injury rates. The secondary objective was to evaluate whether playing position and player age influence injury rates.

The hypotheses were that: a) newcomers have higher injury rates than established players, b) goalkeepers have lower injury rates than outfield players, and c) older players have higher injury rates than younger players.

MATERIALS AND METHODS

An injury surveillance study has been carried out since 2001 in European male professional soccer in collaboration with the Union of European Football Associations (UEFA): the UEFA Champions League (UCL) Injury Study.¹¹ The development of the study design has been published previously.¹⁴

Participants

Data were collected from the UCL study that included players from 26 clubs from 10 countries (Belgium, England, France, Germany, Italy, Portugal, Scotland, Spain, the Netherlands, and Ukraine). The clubs were followed for a varying number of seasons between 2001/02 and 2009/10. In 2000, 14 top European clubs (clubs that had participated at the highest level in Europe over the last decade) were invited by UEFA to take part in the study. Eleven clubs agreed to participate and delivered complete data for the 2001/02 season. Over subsequent seasons, 12 more clubs were selected by UEFA and included in the study, the inclusion criteria being that they delivered complete data over full seasons.¹¹ All players with a first-team contract were invited to participate. In the clubs that entered the study, fewer than five players did not consent to participate. If a player was injured at study inclusion, that injury was not taken into account. Players who left the club before the end of a season were included for as long as they had participated. In total, 1401 players were included in the study, and followed over 3207 player seasons. The mean age of the cohort was 25.8 ± 4.5 years. Playing positions included 140 goalkeepers (10%), 433 defenders (31%), 514 midfielders (37%), and 314 forwards (22%).

Data Collection

The clubs were followed prospectively during full soccer seasons (July to May/June). A representative from each club's medical staff functioned as the contact person between the club and the study group. The contact person was responsible for informing players about the study aims and procedures, as well as for reporting injury and exposure data to the study group. Participation in all training sessions and matches was registered separately on an individual basis in minutes of participation. Three standardized forms were used in the study. A baseline form was used to collect individual player characteristics including age, stature, body mass, dominant leg, playing position, and previous severe injuries and surgeries. The exposure form included club and national team training and match exposures. The injury form contained information about the injury nature and circumstance of injury occurrence. Exposure and injury forms were sent to the study group on a monthly basis and were checked for completeness. Prompt feedback was sent to club contact persons in order to correct any missing or unclear data.

Definitions

The definitions implemented in this study are consistent with the consensus statement established for studies of soccer injuries.¹³ Briefly, a time-loss definition of injury was used, referring to a physical complaint sustained during a soccer training session or match leading to a player being unable to fully participate in future training or match play. A player was regarded as injured until he was declared fit by the club medical staff to fully participate in all types of training and matches. Injury severity was based on the number of days that elapsed from injury to full participation in training and availability for match selection, as decided by the club medical staff. Injury severity was categorized as slight/minimal (time loss of 0-3 days), mild (4-7 days), moderate (8-28 days), or severe (>28 days). Training session was defined as training with the first or reserve team of the club or with a youth or senior national

team. Only team training events that involved physical activity under the supervision of the coaching staff were included. Match play was defined as a competitive or friendly match against another club, or national team matches.

A newcomer to professional soccer was defined as a player undergoing his first season with a first-team contract after being promoted from a club youth academy. All other players were regarded as established players. Players were categorized by the club contact person into the playing positions of goalkeeper, defender, midfielder, and forward. Players were categorized based on sextiles of age distribution within the cohort (≤ 21 , 22-23, 24-26, 27-28, 29-30, and ≥ 31 years). These age categories were chosen to capture the various cutoff values used in previous studies,^{5, 15} as well as to perform a more detailed analysis of the relationship between injury rates and age.

Ethics

The study protocol was approved by the UEFA medical committee and the UEFA football development division. Written informed consent was collected from all players.

Statistical Analyses

For quantitative, normally distributed variables, groups were compared by analysis of variance (ANOVA) with the Bonferroni post hoc test. Injury proportions were compared with the Chi-squared test. Injury incidence is expressed as the number of injuries/1000 exposure hours plus the 95% confidence interval (95% CI). Groups were compared using an incidence rate ratio (RR) and significance was tested with z-statistics.¹⁷ Mean values are presented with corresponding standard deviations.

A Cox regression was used to study the influence of potential risk factors on any time-loss injury. Individual player total exposure (exposure to training and match play) up to an injury event or to the end of the season was set as the time variable. Each player season was handled

as a separate observation. Covariates were time in professional soccer (newcomer/established player), age category, and playing position. All covariates were first assessed by simple Cox regression, with results expressed as a hazard ratio (HR) with 95% CI, and thereafter by multiple Cox regression, including all covariates regardless of significance in the simple analysis. In the multiple analyses, club affiliation and match ratio (match exposure/total exposure) were also included as covariates. Club affiliation was included to adjust for variability in injury rates between clubs, and match ratio was included to adjust for potentially uneven distributions of match exposure, since the match injury rate is known to be several times higher than the rate during training.¹¹ The significance level was set at $P < .05$.

RESULTS

In total, the exposure to training and matches was 669,396 hours and 127,993 hours, respectively. There were 6140 reported injuries (3453 match and 2687 training), resulting in a total injury incidence of 7.7 injuries/1000 hours (95% CI 7.5-7.9), a match injury incidence of 27.0/1000 hours (95% CI 26.1-27.9), and a training injury incidence of 4.0/1000 hours (95% CI 3.9-4.2).

Exposure and Injury Rates for Newcomers vs. Established Players

Newcomers had a lower mean age compared to established players (18.8 vs. 26.0 years, respectively; $P < .001$). Newcomers also had lower mean match exposure (22 vs. 41 hours/season, respectively; $P < .001$) and training exposure (193 vs. 209 hours/season, respectively; $P = .03$) compared to established players.

Newcomers had lower total and training injury incidences compared to established players, while no difference was observed in match injury incidence (Table 1). For newcomers, a lower incidence was found among muscle/tendon injuries and contusions, as well as for both contact and non-contact injuries (Table 1). In contrast, newcomers had a higher incidence of fracture/bone stress injuries. This increased incidence was evident for stress-related bone injuries, while no statistically significant difference was seen for traumatic fractures (Table 1).

Injury Rates Depending on Playing Position and Age

Goalkeepers had a lower match injury incidence in general compared to all outfield positions, but in contrast, had a higher rate of injury to the upper extremity and trunk, as well as a higher rate of injuries caused by contact with an object, such as a goalpost or the ball (Table 2).

Lower overall training and match injury incidences for goalkeepers were found across all age groups. No significant differences were detected between the various outfield playing positions when match and training injury incidences were analyzed separately.

The youngest players (≤ 21 years) had the lowest seasonal match exposure, while only minor differences were seen in training exposure between age groups (Table 3). The match injury incidence was highest in the age group 29-30 years, while training injury incidence was highest in the two oldest age groups (Table 3).

Risk Factor Analyses

Simple Cox regression showed that newcomers had a lower injury rate than established players, goalkeepers had a lower injury rate than all outfield playing positions, and the youngest age group (≤ 21 years) had a lower injury rate than all other age groups (Table 4). The same pattern was repeated in the multiple Cox regression analysis (Table 4).

DISCUSSION

The most important finding in this study was that newcomers to professional soccer clubs had a lower general injury rate than established players, but in contrast, had a higher rate of stress-related bone injuries. Goalkeepers had a lower injury rate in general compared to outfield players, but an increased rate of injuries to the upper extremity and trunk. The overall injury rate increased with age, a pattern that persisted after adjusting for playing position and match exposure.

Low Injury Rates for Newcomers to Professional Soccer

Newcomers to professional soccer had lower injury rates than established players in this study, and the hypothesis that newcomers would have a higher injury rate due to factors such as a lack of physical adaptation to new training methods was thus not supported. The underlying reasons for this finding cannot be determined from this study, but perhaps the low injury rate among newcomers is due to a reduced match load, or to differences in attitudes toward seeking medical assistance.

During their first season with a professional club, newcomers had a lower mean match exposure compared to established players. A congested match fixture has previously been shown to increase injury incidences in soccer.¹⁰ It is thus possible that a moderate match load for these young newcomers was implemented as an injury-prevention strategy in the professional soccer clubs.

Furthermore, it can be speculated that newcomers may be more hesitant to seek medical assistance due to a fear of not being selected at matches. Club medical staffs may also pay more attention to the more experienced players with whom they have established relationships, and who have a higher match load. This scenario may also explain the differences in training incidence between newcomers and established players detected in this study.

In contrast, newcomers had an increased incidence of stress-related bone injuries. A change in total training and match load compared to the academy level could be a contributing factor to this increase. Also, newcomers were significantly younger than their established counterparts, and low age is an established risk factor for stress fractures in elite soccer.¹² Interestingly, injury rates in academy soccer have been shown to increase over the second half of the season, possibly because of a heavy match load.¹⁶

Lower Injury Rates for Goalkeepers

In line with previous studies,^{3, 5} goalkeepers were found to have a lower injury rate than outfield players. Importantly, this finding persisted after adjusting for age, time in professional soccer, and match exposure. Differences in running demands during matches between goalkeepers and outfield players⁹ may explain the lower injury rate for goalkeepers in general and for muscle injuries in particular. In contrast, goalkeepers had a higher rate of upper extremity and trunk injuries, as well as injuries caused by contact with an object. Reaching for the ball may lead to collisions with a goalpost or to unfortunate ball contacts. Also, goalkeepers may be vulnerable to upper extremity and trunk injuries when landing on the ground with their upper extremities away from their body. A large study population is required to study injury patterns among goalkeepers, and the literature regarding injury patterns for elite goalkeepers is mostly limited to case reports. To the authors' knowledge, only one prospective observational study has described injury patterns in goalkeepers compared to outfield players in elite soccer.³ In that study, goalkeepers were found to have a higher rate of head injuries, a finding not repeated in this study. The findings in this study imply that prevention strategies for goalkeepers should have a different focus than strategies for outfield players.

Decrease in Injury Rates for the Oldest Players

Injury rates increased with age, reaching a peak rate among players 29-30 years old. Previous injury is a well-documented risk factor for new identical injury¹⁵ as well as sequels in the same body location;²⁰ and it can be expected that older players will have suffered more injuries during their career.

Having a congested match fixture is associated with higher injury rates in professional soccer,¹⁰ and the absence of a continued increase in injury rate for players ≥ 31 years may be due to a more moderate match load for the oldest players compared to players in their middle 20s. Also, older players who are still able to compete may be less injury-prone than players who retired early from professional soccer. Thus, selection of less injury-prone players that managed to stay in this open cohort may have contributed to the lack of increase in injury risk also involving the oldest players. In this study, a nonlinear association between age and injury rate was detected; one plausible reason for the conflicting results in previous studies^{5,15,18} could be the differences in cutoff values for what is defined as an “old” player.

Methodological Considerations

One of the strengths of this study is its prospective design, which included a large homogeneous group of male professional soccer players. The registration of individual player exposure enabled detailed data control. Therefore, missing or inaccurate data could be corrected by immediate contact between the study group and the club medical staff.

This study also has some limitations in addition to those already discussed. Even though data were collected for nine seasons, the sample of newcomers to professional soccer was relatively small, increasing the risk of type two errors, especially for the analyses of specific injury patterns. Furthermore, no data were available regarding the newcomers' exposure during their previous season as an academy player. Therefore, the potential influence of a

change in training and match quantity/intensity on injury occurrence could not be evaluated in this study.

Finally, players were categorized by clubs according to their playing positions before the start of each season. Occasionally, players change position during a season and sometimes even during a match; the categories for playing position used in the present study, and in others, may thus be less valid. In addition, this classification scheme does not distinguish between injuries that occurred in the attacking or defensive zones of the field, nor between the actual playing situations.

Conclusion

Newcomers to professional soccer had a lower general injury rate than established players, but a higher rate of stress-related bone injuries. Goalkeeping was associated with lower injury rates than all outfield playing positions. Injury rates increased with age, a pattern that persisted after adjusting for playing position and match exposure.

REFERENCES

1. Andersen TE, Larsen Ø, Tenga A, Engebretsen L, Bahr R. Football incident analysis: a new video based method to describe injury mechanisms in professional football. *Br J Sports Med.* 2003;37(3):226-232. PMID: 12782547
2. Andersen TE, Tenga A, Engebretsen L, Bahr R. Video analysis of injuries and incidents in Norwegian professional football. *Br J Sports Med.* 2004 Oct;38(5):626-631. PMID: 15388553
3. Aoki H, O'Hata N, Kohno T, Morikawa T, Seki J. A 15-year prospective epidemiological account of acute traumatic injuries during official professional soccer league matches in Japan. *Am J Sports Med.* 2012;40(5):1006-1014. PMID: 22408048
4. Árnason Á, Tenga A, Engebretsen L, Bahr R. A prospective video-based analysis of injury situations in elite male football: football incident analysis. *Am J Sports Med.* 2004;32(6):1459-1465. PMID: 15310571
5. Árnason Á, Sigurdsson SB, Gudmundsson Á, Holme I, Engebretsen L, Bahr R. Risk factors for injuries in football. *Am J Sports Med.* 2004;32(1 Suppl):5S-16S. PMID: 14754854
6. Bloomfield J, Polman R, Butterly R, O'Donoghue P. Analysis of age, stature, body mass, BMI, and quality of elite soccer players from 4 European Leagues. *J Sports Med Phys Fitness.* 2005;45(1):58-67. PMID: 16208292
7. Chomiak J, Junge A, Peterson L, Dvorak J. Severe injuries in football players. Influencing factors. *Am J Sports Med.* 2000;28(5 Suppl):S58-68. PMID:11032109
8. Dauty M, Collon S. Incidence of injuries in French professional soccer players. *Int J Sports Med.* 2011;32(12):965-969. PMID: 22052029
9. Di Salvo V, Benito PJ, Calderón FJ, Di Salvo M, Pigozzi F. Activity profile of elite goalkeepers during football match play. *J Sports Med Phys Fitness.* 2008;48(4):443-446. PMID: 18997646
10. Dupont G, Nedelec M, McCall A, McCormack D, Berthoin S, Wisløff U. Effect of 2 soccer matches in a week on physical performance and injury rate. *Am J Sports Med.* 2010;38(9):1752-1758. PMID: 20400751

11. Ekstrand J, Hägglund M, Waldén M. Injury incidence and injury patterns in professional football: the UEFA injury study. *Br J Sports Med.* 2011;45(7):553-558. PMID: 19553225
12. Ekstrand J, Torstveit MK. Stress fractures in elite male football players. *Scand J Med Sci Sports.* 2012;22(3):341-346. PMID: 20807388
13. Fuller CW, Ekstrand J, Junge A, Andersen TE, Bahr R, Dvorak J, et al. Consensus statement on injury definitions and data collection procedures in studies of football (soccer) injuries. *Br J Sports Med.* 2006;40(3):193-201. PMID: 17646246
14. Hägglund M, Waldén M, Bahr R, Ekstrand J. Methods for epidemiological study of injuries to professional football players: developing the UEFA model. *Br J Sports Med.* 2005;39(6):340-346. PMID: 15911603
15. Hägglund M, Waldén 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. PMID: 16855067
16. 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. PMID: 10378073
17. Lindenfeld TN, Schmitt DJ, Hendy MP, Mangine RE, Noyes FR. Incidence of injury in indoor soccer. *Am J Sports Med.* 1994;22(3):364-371. PMID: 8037278
18. Morgan BE, Oberlander MA. An examination of injuries in major league soccer. The inaugural season. *Am J Sports Med.* 2001;29(4):426-430. PMID: 11476380
19. Stege JP, Stubbe JH, Verhagen EA, van Mechelen W. Risk factors for injuries in male professional soccer: a systematic review. *Br J Sports Med.* 2011;45(4):375-376. PMID: 21444559
20. Waldén M, Hägglund M, Ekstrand J. High risk of new knee injury in elite footballers with previous anterior cruciate ligament injury. *Br J Sports Med.* 2006;40(2):158-162. PMID: 16432004

TABLE AND FIGURE LEGENDS

TABLE 1

Injury Incidences Split by Time in Professional Soccer^a

TABLE 2

Injury Incidences Split by Playing Position^a

TABLE 3

Player Distribution, Injury Incidences, and Exposure Data Split by Age Category^a

TABLE 4

Hazard Ratios from Simple and Multiple Cox Regression Analyses^a

TABLE 1

Injury Incidences Split by Time in Professional Soccer^a

	Time in Professional Soccer		Rate Ratio (95% CI)	<i>P</i> value
	Newcomer ^b	Established player		
Player seasons, <i>n</i> (%)	116 (4)	3091 (96)	-	-
General injury incidence				
Total	5.2	7.8	0.66 (0.56-0.79)	<.001
Training	3.1	4.0	0.76 (0.60-0.97)	.03
Match	23.6	27.0	0.87 (0.68-1.13)	.30
Injury circumstance ^c				
No contact	2.7	3.7	0.73 (0.57-0.92)	.01
Contact player	1.2	1.9	0.65 (0.45-0.93)	.02
Contact object	0.04	0.1	0.43 (0.06-3.11)	.40
Injury type				
Fractures/bone stress	0.60	0.34	1.77 (1.05-2.97)	.03
Traumatic fracture	0.40	0.27	1.51 (0.80-2.85)	.20
Stress related bone injury	0.20	0.08	2.69 (1.08-6.69)	.03
Joint/ligament	1.8	1.9	0.92 (0.68-1.24)	.59
Muscle/tendon	1.6	3.6	0.43 (0.32-0.60)	<.001
Contusions	0.6	1.3	0.51 (0.31-0.84)	.01
Laceration	0.1	0.1	1.99 (0.62-6.38)	.25
CNS/PNS	0.04	0.1	0.40 (0.06-2.87)	.36
Other	0.4	0.5	0.86 (0.46-1.62)	.65
Injury location				
Head/neck	0.04	0.2	0.23 (0.03-1.65)	.14
Upper limbs	0.4	0.2	1.66 (0.88-3.14)	.12
Trunk	0.3	0.5	0.62 (0.31-1.24)	.17
Lower limbs	4.4	6.8	0.64 (0.53-0.78)	<.001

^aDetailed injury information was missing for eight injuries, which are only included in general injury incidence. CNS, central nervous system; PNS, peripheral nervous system; Injury incidence, Injuries/1000 exposure hours; CI, confidence interval.

^bA newcomer to professional soccer was defined as a player undergoing his first season with a first-team contract after being promoted from a club youth academy.

^cData collected for seasons 2004/05 to 2009/10 only.

TABLE 2
Injury Incidences Split by Playing Position^a

	Playing Position						
	Goalkeeper ^b	Defender	<i>P</i> value	Midfielder	<i>P</i> value	Forward	<i>P</i> value
Player seasons, <i>n</i> (%)	348 (11)	1044 (33)	-	1153 (36)	-	662 (20)	-
General injury incidence							
Total	4.6	8.3	<.001	8.2	<.001	7.6	<.001
Training	3.5	4.0	.03	4.2	.01	4.0	.05
Match	12.1	28.6	<.001	29.2	<.001	27.3	<.001
Injury circumstance ^c							
No contact	3.2	5.3	<.001	5.1	<.001	5.0	<.001
Contact player	0.9	2.6	<.001	2.8	<.001	2.4	<.001
Contact object	0.3	0.1	.003	0.1	.005	0.1	.08
Injury type							
Fractures/bone stress	0.3	0.3	.54	0.4	.15	0.3	.98
Joint/ligament	1.2	2.0	<.001	2.1	<.001	1.8	<.001
Muscle/tendon	1.8	3.9	<.001	3.8	<.001	3.7	<.001
Contusions	0.7	1.3	<.001	1.4	<.001	1.2	<.001
Laceration	0.03	0.10	.07	0.05	.57	0.05	.47
CNS/PNS	0.04	0.13	.04	0.09	.13	0.09	.18
Other	0.7	0.5	.07	0.4	<.001	0.5	.06
Injury location							
Head/neck	0.2	0.2	.49	0.1	.21	0.1	.19
Upper limbs	1.0	0.2	<.001	0.2	<.001	0.1	<.001
Trunk	0.7	0.5	.02	0.5	.01	0.4	.001
Lower limbs	2.7	7.4	<.001	7.4	<.001	7.0	<.001

^aDetailed injury information was missing for eight injuries, which are only included in the general injury incidence. CNS, central nervous system; PNS, peripheral nervous system; Injury incidence, Injuries/1000 exposure hours.

^bReference group for playing position in analysis.

^cData collected for seasons 2004/05 to 2009/10 only.

TABLE 3

Player Distribution, Injury Incidences, and Exposure Data Split by Age Category^a

	Total	≤21	22-23	24-26	27-28	29-30	≥31
Distribution							
Number of player seasons	3207	645	445	746	476	381	514
Player exposure per season ^b							
Training hours	207 ± 73	199 ± 78	211 ± 71	212 ± 72 ^d	210 ± 75	208 ± 70	204 ± 70
Match hours	40 ± 24	30 ± 22 ^e	41 ± 24 ^d	43 ± 24 ^d	45 ± 25 ^d	44 ± 24 ^d	38 ± 24 ^{d,e}
Injury incidence ^c							
Training	4.0	4.0	3.7 ^e	3.8 ^e	3.9	4.4	4.4
Match	27.0	25.4	28.1 ^e	26.8	25.0 ^e	30.7 ^d	26.8 ^e

^aBased on sextiles from age distribution. Age ranges listed are in years.^bValues are means ± standard deviations.^cInjuries/1000 exposure hours.^dSignificantly different from ≤21 years category, $P < .05$.^eSignificantly different from 29-30 years category, $P < .05$.

1

TABLE 4

2

Hazard Ratios from Simple and Multiple Cox Regression Analyses^a

Covariates	Simple analysis			Multiple analysis ^b		
	HR	95% CI	<i>P</i> value	HR	95% CI	<i>P</i> value
Time in professional soccer						
Newcomer ^c	0.77	0.60-0.96	.02	0.77	0.61-0.99	.04
Established player ^d	1.00	-	-	1.00	-	-
Playing position						
Goalkeeper ^d	1.00	-	-	1.00	-	-
Defender	1.70	1.47-1.97	<.001	1.91	1.64-2.24	<.001
Midfielder	1.60	1.38-1.85	<.001	1.78	1.53-2.07	<.001
Forward	1.65	1.41-1.93	<.001	1.82	1.55-2.14	<.001
Age category						
≤21 years ^d	1.00	-	-	1.00	-	-
22-23 years	1.20	1.04-1.38	.01	1.22	1.07-1.44	.004
24-26 years	1.20	1.06-1.35	.005	1.28	1.12-1.46	<.001
27-28 years	1.20	1.05-1.38	.009	1.29	1.11-1.49	.001
29-30 years	1.34	1.16-1.55	<.001	1.44	1.24-1.68	<.001
≥31 years	1.17	1.02-1.35	.02	1.28	1.11-1.48	.001

3

^aResults are presented as hazard ratio (HR) and 95% confidence interval (95% CI).

4

^bIncluding the covariates time in professional soccer, playing position, age category,

5

club affiliation, and match ratio (match exposure/total exposure).

6

^cA newcomer to professional soccer was defined as a player undergoing his first season with a first-team contract after being promoted from a club youth academy.

7

8

^dReference group within category.

