

The impact of playing in matches while injured on injury surveillance findings in professional football

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This study aimed to analyze the frequency, nature, and consequences of footballers playing matches while injured, and to examine the impact on injury surveillance findings. High levels of inter-rater reliability and content validity were established for a tool designed to document players who were already injured at the start of a match. The tool was implemented in three English football teams (a Championship, League 1, and League 2 team) for one season, using a “time loss” definition of injury. One hundred forty-three matches were surveyed, revealing 102 match appearances by players who were already injured. Almost half of all games featured at least one

injured player, with episodes of playing with injury occurring more frequently and lasting longer in League 2 players compared with higher level players. No association was observed between the number of injured players starting matches and match outcome [$\chi^2(4, N = 143) = 3.27, P = 0.514$]. Fifteen percent of all injury episodes captured were only through prospective documentation of playing while injured. The findings show that both traumatic and overuse injuries are managed by footballers through competitive matches, and have important implications for aiding understanding of the epidemiology of injury in professional football.

The published consensus statement on injury definitions and data collection procedures in studies of football (soccer) injuries (Fuller et al., 2006) has been widely cited, guiding researchers to internationally accepted methods for collecting, analyzing, and interpreting football injury surveillance data. Through the adoption of mixed definitions (any physical complaint, medical presentation, and time loss definitions concurrently), this framework appears to circumvent criticisms levied at many injury surveillance studies concerning a poor representation of continuing to play when injured with overuse syndromes. Nevertheless, recent evaluation of the prevalence and severity of overuse injury through new registration methods suggests that overuse injuries are still dramatically underreported in most papers and are not captured effectively through traditional surveillance approaches, contributed to by researchers continuing to adopt time loss definitions (Bahr, 2009; Clarsen et al., 2013).

Separately, there is evidence from the social sciences that in professional football, fear of losing one's place in the team, avoiding loss of contract bonuses, and wanting to play because of the significance of forthcoming games are common incentives to continue to play when injured (Roderick, 2006; Hammond et al., 2013). “Playing” is suggested to have central importance to footballers, who

have strongly masculine self-images and demonstrate a strong sense of professional pride (Roderick et al., 2000; Roderick, 2006). Issues and behavioral practices such as delaying surgery to the off-season and playing when injured in high-importance games are purported to impact on injury surveillance findings (Hammond et al., 2009, 2011). However, to the best of our knowledge, prospective documentation of playing in matches while injured or in pain has not been conducted in professional football to date, and there has been no evaluation of whether acute injuries are “managed” through matches in a similar way to overuse injuries.

Therefore, the aims of this study were (a) to validate purpose-designed methods to prospectively record instances of participation in professional football matches while injured; (b) to analyze the frequency, nature, and consequences of professional football players in the English football league playing while injured; and (c) to examine the extent to which these practices impact upon injury surveillance findings.

Methods

This study took place in two phases: initially, a purpose-designed tool was developed and evaluated in order to prospectively document incidents of playing in matches with injury; secondly, the

tool was implemented within three professional teams in the English football league. Participants involved in each phase gave written consent to take part in the study, which was approved by the University of Nottingham Medical School Research Ethics Committee.

Phase 1: Validity and reliability of a data collection tool

A form was developed to determine the injury status of all members of the match squad at the beginning of the match, in order to document instances of footballers playing in matches while injured. It also captured additional information about what the injury was, why they were playing while injured, and whether any new injuries were sustained during the game. Validity and reliability of this form was evaluated.

Procedure

An expert sample of nine physiotherapists, all of whom currently work or had previously worked within professional football, were sampled by convenience and snowball to evaluate reliability and validity of the tool. Physiotherapists were chosen as they are frontline medical personnel in professional football who are well positioned to be able to make the judgments about player status that the forms require. Participants were given standardized information about the tool, and then watched a short DVD showing real match footage with accompanying match injury information (including a team sheet showing the current injury status of each squad member).

After completing the data collection tool, the experts were invited to give their opinions on the tool to establish content validity. Participants independently rated each individual item on the tool using a content validity index (CVI; Lynn, 1986), rating each item on a scale of 1–4 (1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, and 4 = very relevant). Ratings included both whether the individual question was relevant and appropriate to playing in a football match while injured, and whether the individual question (and its preset responses if given) adequately measured all dimensions of that aspect of playing in a football match while injured.

Analysis

Interobserver agreement was evaluated for each item on the form using Fleiss' kappa (k) (Fleiss, 1971).

Proportional agreement between raters was calculated to analyze content validity for individual items on the tool [item-level CVI (I-CVI)], with the average of the I-CVI's used to calculate the overall scale-level CVI (S-CVI; Polit & Beck, 2006). An S-CVI of greater than 0.90 was considered an acceptable level of content validity (Waltz et al., 2005).

Phase 2: Surveillance of playing in matches while injured

A prospective cohort study was undertaken of three professional football teams in the English football league. Seventy-eight players contracted to the first team squads of a Championship club ($n = 31$, age 25.0 ± 5.6 years), a League 1 club ($n = 25$, age 26.0 ± 4.4 years), and a League 2 club ($n = 22$, age 24.0 ± 5.0 years) participated in the study. Injuries were documented for the competitive season between August 2009 and May 2010.

Procedure

A match form was completed by the team physiotherapist for every league or cup game during the observation period. The form

recorded information for all players in the match squad (including substitutes), specifically their playing status, whether they were injured going into the match and the diagnosis of any new match injury sustained. The form also asked for a judgment around the reason for the footballer playing with injury (if applicable), in order to identify participants for a qualitative study that has been described elsewhere (Hammond et al., 2013). To capture injuries occurring outside of match play, new injury forms were completed, which required information about the injury date, diagnosis, and type of injury (new or recurrent). At the end of the season, information was collected concerning which players were receiving ongoing treatment through the off-season.

Injury diagnoses were classified using Orchard Sports Injury Classification System version 10 (Rae & Orchard, 2007). Forms were collected from participating clubs by the lead investigator in person on either a weekly or fortnightly basis. Individual match exposure time and match outcome (win, loss, draw) was obtained from published match reports.

Injury surveillance definitions

It was initially intended that "any physical complaint" definition (Fuller et al., 2006) would be used in this study in order to capture all possible football injuries including overuse conditions. However, the physiotherapists involved in the injury reporting expressed concern over the reliability of this definition, and requested pragmatic, objective criteria for injury registration. Therefore, a "time loss" definition was used, where injury was defined as "an injury that results in a player being unable to take a full part in future football training or match play" (Fuller et al., 2006).

Previously published definitions for recurrence (Fuller et al., 2007) and for traumatic and overuse injuries (Fuller et al., 2006) were adopted.

Analysis

Descriptive analysis of the data around playing in matches while injured was undertaken, with frequencies and percentages reported. These values were calculated for all players and were compared between playing levels. The relative risk was calculated for the chance of playing with injury at different playing levels. A chi-square test was used to determine whether including injured players in a team was associated with match outcome. Where appropriate, 95% confidence intervals (CIs) were calculated.

Results

Inter-rater reliability and content validity of the tool

Agreement between raters was generally good when using the tool, with k values ranging from 0.53 to 0.86 (Table 1). I-CVI was acceptable for all items, with an S-CVI of 0.97.

Playing in matches when injured

One hundred forty-three completed match forms were returned from an expected 143 games, indicating 100% compliance by physiotherapists. A total of 206 injuries were captured during the observation period, 32 of which were detected through identifying athletes playing in matches when injured (Table 2).

Impact of playing in matches while injured

Overall, 102 instances were documented where athletes played in matches while injured; these instances were derived from 45 injury episodes occurring within 25 individual players, representing 5.2% of all match appearances as a starter or substitute. Six percent of all match time surveyed was played by an injured player (95% CI: 5.1–7.1%). The mean duration of injury episodes that were managed through matches by footballers increased as the playing level decreased (Fig. 1).

There was at least one injured player reported in the match squad in 48% of all games surveyed, with the vast majority of these players being match starters rather than substitutes. Differences were observed between leagues, with only 15% of League 2 games fielding a fully fit match squad in the season. One third of all footballers played in at least one match when injured, with greater percentages of the squad in lower leagues having played with injury compared with higher leagues (26%, 32%, and 41% for Championship, League 1, and League 2 players, respectively). League 2 players were 1.3 times more likely to participate in matches while injured than League 1 players (95% CI: 0.60–2.74), and 1.6 times more likely than Championship players (95% CI: 0.73–3.46).

A variety of hard- and soft-tissue injuries were managed through match play, including fracture, muscle strain, joint sprain, bursitis, hernia, disc pathology, tendinopathy, meniscal lesion, and osteochondral lesion. At all playing levels, approximately half of the injuries

that were played on in matches were traumatic and half were overuse. No association was observed between the number of injured players starting matches and match outcome [$\chi^2(4, N = 143) = 3.27, P = 0.514$] (Table 3).

Of the 45 episodes of match play with injury, 71% were only detected through the purpose-designed form and not through any other means (Table 4). This represents 15% of all injury episodes captured. Reanalysis of the data revealed that 50% of the total injuries captured (through whatever means) would not have been recorded if a “match time loss only” (Orchard & Hoskins, 2007) definition were used.

Discussion

This is the first study to prospectively document the occurrence of playing in matches while injured in professional football, and this provides important information about the wide use of injured players. These findings address current gaps in knowledge that are

Table 1. Level of agreement and interpretation for items on the purpose-designed tool

Item	Reliability		Validity
	<i>k</i>	Interpretation (Landis & Koch, 1977)	I-CVI
Player status	0.79	Substantial agreement	1.0
Current injury being treated	0.86	Almost perfect agreement	0.88
Information relating to match participation	0.53	Moderate agreement	1.0
New match injury	0.76	Substantial agreement	1.0

I-CVI, item-level content validity index.

Table 2. Summary of descriptive statistics surrounding playing in matches while injured

	Total	By playing level		
		Championship	League 1	League 2
Games surveyed (<i>n</i>)	143	46	50	47
Player match appearances surveyed (<i>n</i>)*	1959	631	690	638
Match appearances while injured (<i>n</i>)	102	24	17	61
Episodes [†] of match play with injury (<i>n</i>)	45	18	10	17
Proportion of games with one or more players in the match squad that were already injured	48%	33%	30%	85%
Duration of match play while injured recorded (hours)	125.9	32.7	16.8	76.4
Hours of match play while injured per 1000 match hours	53.4	43.1	20.4	98.0

*Including appearances as a substitute.

[†]Where an episode is defined as a period in which a player participates in one or more consecutive matches while injured.

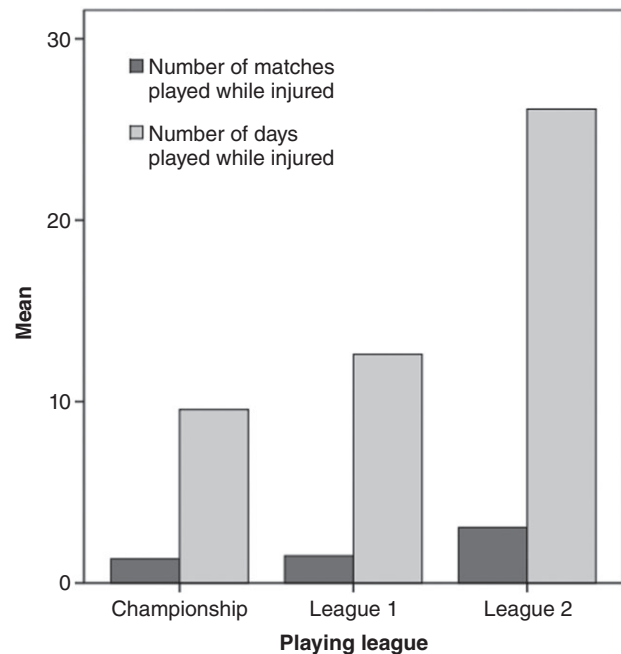


Fig. 1. Mean duration of episodes of playing while injured.

Table 3. Cross-tabulation of number of starters in match squad with an existing injury with match outcome

		Match outcome			Total
		Won	Lost	Drew	
Number of players	0	35	34	15	84
	1	15	15	11	41
	2 or more	9	4	5	18
	Total	59	53	31	143

Table 4. Analysis of source of injury information gathered

Source	<i>N</i>	% of all injuries recorded
Match form (preexisting injury)	32	15
Match form (new match injury)	105	51
New injury form	67	33
End of season injury form	2	1
Total	206	100

present in football injury surveillance, relating to minimal acknowledgement within epidemiological studies that playing while injured occurs, despite qualitative evidence to suggest that this happens regularly.

Playing in matches while injured

The findings of this study show that professional football players commonly play in matches while injured, and that both traumatic and overuse injuries are managed by footballers through competitive matches. These findings support notions from the field of sociology surrounding athletes working within a culture of risk (Nixon, 1992, 1994; Young, 1993), and quantify that, which has been shown qualitatively where professional footballers normalize pain and endure injury (Roderick et al., 2000; Roderick, 2006; Hammond et al., 2013). Revealing the rates of athletes continuing to play while injured has important implications in helping to understand the nature and frequency of injury in professional football.

Differences in practices around playing while injured seem apparent between playing leagues, with lower league players continuing to play while injured more frequently, and for longer periods of time, than their higher level counterparts. These findings also suggest a greater chance of playing with injury if contracted to a lower level team than higher level team. There may be several reasons contributing to these differences, e.g., restrictions in the size of the available squad may constrain players to make match appearances when injured. This has been shown through interviews with injured footballers who continued to play while injured (Hammond et al., 2013). The financial position of teams in terms of income, turnover, and expenditure varies substantially across leagues within English football (Amir & Livne, 2005), and the higher the playing league, the more money a team has to invest in player assets. It

is therefore likely that the squads of higher league teams will be able to more effectively absorb the impact of injured, ill, or suspended players with minimal effects on team performance than lower league teams (Hammond et al., 2013).

There has been much discussion of the difficulties in gathering accurate data for overuse injury through injury surveillance studies (Bahr, 2009; Clarsen et al., 2013), and this study lends support to suggestions that overuse injuries are commonly managed (through both conservative and invasive means) and therefore may go unreported in injury surveillance (Hammond et al., 2011). As it is also shown here, some traumatic injuries can also present a problem for reporting, and we suggest that a similar rate of traumatic injuries to overuse injuries may be underestimated in some studies.

Methodological considerations

These data are limited by the small sample of only three teams, observed for only one season. Studies of this size should be interpreted with caution as they prevent statistical power being achieved, preclude identification of risk factors, and cannot capture the full range of both common and rare injuries. This sample cannot be considered statistically representative; however, to not report the findings of this novel, preliminary examination would be a mistake. Understanding the frequency and impact of using injured players is an important aspect of the epidemiology of professional football, and these initial observations should initiate scientific discourse of this important topic.

A further impact of sample size relates to the comparison of data between playing levels. Because only one team was recruited from each league, differences identified between rates of playing in matches while injured might be influenced by factors other than playing level. It is suggested that the local culture of a professional football team is determined by the manager and their particular managerial style (Roderick et al., 2000); therefore, the differences observed between teams could reflect the particular managerial culture rather than the playing level *per se*. A larger study with a representative sample of a greater number of teams recruited from each playing level, observed over multiple seasons, is required in order to validate the findings reported here and to explore the impact of playing in matches while injured more fully.

In any injury surveillance study, the definition of injury that is used impacts on the breadth of data gathered (Hodgson et al., 2007; Orchard & Hoskins, 2007). The restriction of “time loss” was used in this study for pragmatic reasons described earlier. Issues of reliability in injury definitions have been highlighted and discussed previously (Orchard & Hoskins, 2007), and form the main argument against using all-encompassing definitions in injury surveillance. Had an “any physical complaint” definition been used in this study, it is likely that

a greater number of injuries and instances of playing while injured would have been recorded. It is also likely that the decrease in injury rate when reanalyzing the data with a “match time loss only” definition would be greater than 50% if an all-encompassing definition had been used.

The prospective approach to injury documentation adopted in this study is positive and should serve to improve the completeness of the reporting by medical staff, as retrospective designs have been criticized for recall bias (Junge & Dvorak, 2000; Rothman, 2002). However, it has been shown that up to one fifth of time loss injuries may be underestimated by medical staff reporting injuries in professional football prospectively (Bjorneboe et al., 2011), where forms are often completed retrospectively on a monthly basis, thereby introducing a recall bias to the findings. In this study, match forms were completed for every game, regardless of presence or absence of injury, with a compliance level of 100% observed. It is not known whether a response rate of this magnitude could be maintained in a larger scale study over an observation period spanning more than one season, as reporting on every player in every match is a burdensome task for medical teams. The collection of documentation on a weekly or fortnightly basis should reduce the risk of retrospective biases affecting this study. However, no verification of the data through alternative sources was made to quantify the accuracy and completeness of these data.

CVI was used in this study to calculate content validity of the tool used to capture instance of playing while injured, evaluated by expert raters. This popular method that evaluates proportional agreement among raters, however, has been criticized for collapsing four ordinal response rankings into two dichotomous categories (content valid/content invalid), which increases the risk of random chance agreement (Wynd et al., 2003).

Implications for clinicians, researchers, and players

It is likely that many of the injuries that go unreported through surveillance comprise an important injury subgroup that takes up a lot of time and resources of the medical team. For example, an individual requiring a series of injections over the course of a season in order to continue to play will probably consult with the medical team regularly, may frequently not train alongside the main team, and may require additional treatments from external sources. Although the overall number of injuries that are managed in this way remains relatively low compared with the overall injury burden, they are still likely to have a significant impact on a club and are therefore noteworthy, and therefore should be included in reports of injury in professional football.

It appears that there is no particular detrimental effect on team performance when including injured players in a team, although more research is required to explore

this further. However, these practices may have longer term implications on player health. These findings raise important issues for medical teams working in professional football, although coaches and administrative staff may be dismissive of these issues unless they are harmful to results and economy (Ekstrand, 2013).

The findings reported here support calls for a scheduled winter break in English league football, something that is commonplace within Europe but not in England. A break in the calendar would enable time for physical and psychological recovery for all athletes, and would provide designated time for athletes who are managing injuries to rest and rehabilitate their injuries midway through the season.

The methods used in this study were designed to answer a specific research question around the frequency of playing in matches while injured, not to attempt to replace the methods proposed by Fuller et al. (2006). It is intended that the findings will help to develop a better understanding of how behavioral factors might impact on epidemiological findings in professional football, and where differences may lie between practices at different playing levels.

Perspectives

The extensive body of injury surveillance literature in professional football has importance for researchers and clinicians that use evidence-based strategies to reduce injury rates and improve injury outcomes in elite sport. This study adds to that body of literature by giving an impression of the magnitude of the issue of playing in matches while injured in professional football. The findings indicate characteristics around athletes playing while injured that have relevance to both the interpretation of epidemiological studies and for the understanding of the medical management of footballers. This is of increasing contemporary interest, with recent evidence showing widespread and systematic use of medication, particularly pain-killing agents, by players who participated in the 2010 football World Cup (Tscholl & Dvorak, 2012). Our findings present a novel view of the landscape of injury in professional football and how it may vary at different playing levels, which is beneficial to both clinicians working in a football environment, and to researchers conducting injury surveillance studies and using these to drive preventative strategies.

Key words: epidemiology, overuse injury, pain, soccer.

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