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Original research

Does player unavailability affect football teams' match physical outputs? A two-season study of the UEFA champions league

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ABSTRACT

Objectives: Player unavailability negatively affects team performance in elite football. However, whether player unavailability and its concomitant performance decrement is mediated by any changes in teams' match physical outputs is unknown. We examined whether the number of players injured (i.e. unavailable for match selection) was associated with any changes in teams' physical outputs.
Design: Prospective cohort study.
Methods: Between-team variation was calculated by correlating average team availability with average physical outputs. Within-team variation was quantified using linear mixed modelling, using physical outputs – total distance, sprint count (efforts over 20 km/h), and percent of distance covered at high speeds (>14 km/h) – as outcome variables, and player unavailability as the independent variable of interest. To control for other factors that may influence match physical outputs, stage (group stage/knockout), venue (home/away), score differential, ball possession (%), team ranking (UEFA Club Coefficient), and average team age were all included as covariates.
Results: Teams' average player unavailability was positively associated with the average number of sprints they performed in matches across two seasons. Multilevel models similarly demonstrated that having 4 unavailable players was associated with 20.8 more sprints during matches in 2015/2016, and with an estimated 0.60–0.77% increase in the proportion of total distance run above 14 km/h in both seasons. Player unavailability had a possibly positive and likely positive association with total match distances in the two respective seasons.
Conclusions: Having more players injured and unavailable for match selection was associated with an increase in teams' match physical outputs.

1. Introduction

Injuries are common in professional football,[1,2] and negatively affect team performance.[3–5] While the link between injuries and team performance has been established,[5] the mechanisms through which injuries affect teams' match play and subsequent performance has not been investigated. Given the multifaceted nature of team sport performance, having more players unavailable may cause teams to alter their tactics, may result in worse technical proficiency as less-skilled players are selected, and may result in altered physical performances during match play. While all these avenues provide future research opportunities, we will focus on the association between player unavailability and football teams' match physical outputs.

Individual players' physical outputs – including their total distance run, high speed distance run, number of sprints performed, time spent at different velocities, number of repeated sprint demands, and many other variables – are now readily quantified. This has enabled researchers to examine intra- and inter-individual variation over successive matches,[6–8] as well as the effects of player

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position,[9] team formation,[10] team ranking,[11] and fatigue (transient and end-game).[12] To our knowledge, whether the number of players injured and therefore unavailable for selection is related to any changes in football teams' physical outputs has not been examined.

If player unavailability is associated with changes in match physical outputs, sports medicine and science staff may benefit in two ways. First, the impact of injuries may be more readily quantified — improving preventative efforts. Second, teams with more players unavailable for selection may better understand what to expect in coming matches and therefore prepare appropriately. Therefore, our objective was to investigate whether player availability was associated with any changes in teams' match physical outputs. Theoretically, having more players unavailable due to injury may cause less 'match fit', or more inexperienced players to be selected for match play, and reduce teams' ability to utilize squad rotation during times of fixture congestion. Therefore, we hypothesized that player unavailability would be associated with a decrease in teams' physical outputs.

2. Methods

The UEFA Champions League (UCL) injury study is an ongoing prospective injury surveillance study of male professional football that started in 2001.[13] The current study cohort followed the teams participating in the UCL injury study who competed in the 2014–2015 and 2015–2016 UEFA Champions League competitions. Only UCL matches were included, without any league matches. UCL fixtures are generally played every 2–3 weeks on Tuesdays and Wednesdays between September and May. Teams play 6–12 matches depending whether they advance to the knockout stage and how long they remain in the competition.

Data collection procedures and definitions followed the UEFA guidelines,[13] and were consistent with the consensus statement for injury surveillance in football.[14] All players completed informed written consent and the study design was approved by the UEFA Medical Committee.

First teams' medical staff members logged all injuries on a standard injury form, sent to the study group each month. A time-loss injury definition was used for this investigation, with injuries recorded whenever a player's physical complaint prevented full football training or match play.[14] Players were considered injured until the medical staff allowed full participation in training and availability for match selection. The number of players unavailable due to injury was calculated for each match as the 'count' of how many players were designated as 'injured' on the date of the match and therefore unavailable for selection. Players unavailable due to international duty, yellow cards, or other reasons were not included in this count.

Performance data were collected through video tracking and analysed by Deltatre. These are the same data Deltatre analyses for UEFA and reports to teams during and after matches.[15] The analysis algorithm used to calculate physical outputs was consistent across seasons, but the video tracking hardware provider changed between seasons — Stats in the 2014/2015 UCL Season and ChyronHego in the 2015/2016 Season. Therefore, we chose to analyse each season separately.

Physical output data included total distance run (km); distance run (km) and time spent (minutes) at low, medium, and high-speeds; number of sprints performed (n). Speed thresholds were set at <0–10 km/h for low intensity, <10–14 km/h for medium intensity, >14 km/h for high intensity, and 20 km/h for sprinting.[6,16] We specifically selected three physical output variables for this analysis — (1) total distance run, (2) number of sprints, and (3) percentage of total distance performed at high speeds (>14 km/h). These outcome variables were chosen to examine both match volume (total distance) and match intensity (sprint count and % of distance above high speeds). Two matches were excluded due to technological errors (no sprints were recorded by the video tracking software), and 9 matches were excluded which went to extra-time, as the physical outputs of these matches were outliers for all analyses.

Both match and team characteristics were collected and included in the multilevel models as covariates. Match characteristics included ball possession (% of match time), score differential (e.g. −3, −1, +2, etc.), venue (Home/Away), and competition stage (Group Stage/Knockout). Team characteristics included average team age and team quality (determined by UEFA Club Coefficients).

Descriptive analyses and visualization were completed in the open-source statistical software, R (Version 3.2.2), using the *dplyr* and *ggplot2* packages. Multilevel models were constructed using HLM 7.01 for Windows.[17] Magnitude-based inferences for correlations and t-distributed statistics were calculated using a custom spreadsheet.[18] In accordance with previous approaches, we defined the smallest worthwhile change in each output variable as 0.2 times the between-team standard deviation, and as 0.1 for correlation coefficients. Finally, we examined the association between player absences and each outcome variable by analysing the change associated with a 2 standard deviation change in the number of players absent.[19]

Results are expressed as means ± standard deviations. To examine the association between player unavailability and physical output, two approaches were used. First, across the season, between-team differences were calculated using Pearson correlation coefficients, examining the relationship between teams' average player unavailability and their average physical outputs. Second, within-team effects of player unavailability were examined using multilevel (mixed/random effect) linear regression — modelling the three physical outputs as outcome variables, with player availability as the explanatory variable of interest.

Multilevel models were performed with match observations (Level 1) clustered within teams (Level 2). This modelling approach was chosen for its ability to handle the data dependency created by repeated measures of the same teams, the unbalanced data formed as teams participated in different numbers of matches throughout the competition,[20,21] and recent recommendations for mixed models to be used in these types of analyses.[22] Following previous recommendations, we included all level 1 covariates as random effects, including level 1 covariates in raw metrics if they held a meaningful 0 point (score differential, 0 = draw), while centring other continuous variables (ball possession) at the group mean (a.k.a. centring within cluster) — recommended when trying to examine the effect of another Level 1 variable.[23] The full model building strategy can be seen in Table A1, and all the multilevel model outputs are included as supplementary material. Where sample size allowed, we used the robust standard errors calculated in HLM.

3. Results

In 2014–2015, 23 teams were included with 180 match observations. In 2015–2016, 20 teams were included, with 158 match observations. Fourteen teams participated in both UEFA seasons (total n = 29). The breakdown of teams' demographic information as well as injury breakdown is included in Table A2.

Player unavailability ranged from 0 to 8 players unavailable due to injury on match day, with an average of 2.1 players unavailable in 2014/2015 (SD = 1.91) and 2.7 players in 2015/2016 (SD = 1.84). Rounding these standard deviations to the nearest integer (2), we calculated the changes in our outcome variables associated with 4 players unavailable for selection (2 × SD).[24] The distribution of player unavailability for each team across each month of play is shown in the Appendix B (Fig. B1).

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