Teamwork execution and team resilience: A multi-study examination of reciprocal and longitudinal relationships

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Author note

Acknowledgements: This work was supported by the Junta de Extremadura (Ministry of Economy, Science and Digital Agenda) with the contribution of the European Union through the European Regional Development Fund (GR21124) and the Government of Spain (Ministry of Education, Culture and Sports, FPU17/03489 and IJC2019-040788-I).

The datasets generated during the current multi-study paper are publicly available on the open science framework (OSF) at: Study 1 https://osf.io/p8kyg/; Study 2 https://osf.io/fv84u/

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Abstract

The purpose of this multi-study paper was to examine relationships between variables within an input-mediator-outcome (IMO) framework of team effectiveness in sport over the course of a competitive season. In Study 1, 1,566 athletes (M_{age} = 22.1 years, *SD* = 5.2) from 104 teams completed measures of teamwork execution and team resilience at two timepoints (two months apart) during a season. Multilevel structural equation modeling (MSEM) revealed significant, reciprocal, and positive relationships between teamwork execution and characteristics of resilience, as well as significant, reciprocal, and negative relationships between teamwork execution and vulnerability under pressure, from Time 1 (T1) to Time 2 (T2) at both the individual and team level. Study 2 built on these findings by testing propositions from the IMO model of team effectiveness. Measures of perceived athlete leadership quality (input; T1), teamwork execution and team resilience (mediators; T2), and team performance (outcome; Time 3 [T3]) were completed by 1,117 athletes (M_{age} = 24.8, *SD* = 5.6) within 92 teams over eight months. MSEM showed perceived athlete leadership quality had significant positive association with teamwork execution and characteristics of resilience at player and team levels, and significant negative relationship with player-level vulnerability under pressure. Of the mediators assessed at T2, only teamwork execution had a significant and positive relationship with perceived team performance at T3, specifically at the player level. Our findings highlight the reciprocal relationship between teamwork execution and team resilience, the importance of athlete leadership in fostering these mediators, and the associations of those variables on perceptions of team performance.

Keywords: group dynamics, leadership, performance, team sport, vulnerability under pressure.

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Bringing a group of highly-skilled individuals together is not sufficient for teams to be effective. Rather, team members need to work well together to achieve their objectives (LePine et al., 2008; Rousseau et al., 2006). Although considerable evidence points to the importance of *teamwork* as a means of supporting team functioning across several group contexts (e.g., business, health care, military, and academic settings; LePine et al., 2008; Mathieu et al., 2008), teamwork in sport has only recently begun to receive formal research attention. In an attempt to bring greater conceptual clarity and stimulate research on this construct in sport, McEwan and Beauchamp (2014) conducted a conceptual and integrative review of research on teamwork in sport and other team settings. Based on their review, they proposed that teamwork is "a collaborative effort by team members to effectively carry out the independent and interdependent behaviors that are required to maximize a team's likelihood of achieving its purposes" (p. 233). Furthermore, a multidimensional conceptual framework of teamwork and team effectiveness in sport was put forward, whereby teamwork was positioned as a key mediator within an input-mediator-outcome (IMO) model of team effectiveness.

According to McEwan and Beauchamp (2014), there are 14 behavioral dimensions of teamwork, which are categorized into five interrelated components: *preparation*, *execution*, *evaluation*, *adjustments*, and the *management of team maintenance*. Of interest to the current study, teamwork execution occurs during action episodes where teams compete against one another (i.e., competitive gameplay; Marks et al., 2001; McEwan & Beauchamp, 2014), and is considered the most relevant and proximal predictor of team performance outcomes among the five teamwork components. In terms of specific behaviors, teamwork execution comprises intrateam communication (i.e., the dynamic exchange of information between teammates),

coordination (i.e., the synchronization between teammates to perform diverse actions correctly), and cooperation (i.e., teammates working together as one strong entity and in a unified manner) during gameplay.

Within the IMO model of team effectiveness (McEwan & Beauchamp, 2014), teamwork is proposed as a *team process* that has a reciprocal relationship with *emergent states*—that is, affective, motivational, and cognitive states that arise as a team develops (e.g., team cohesion, collective efficacy, team resilience). Team processes and emergent states are described as dynamic variables and constitute the 'mediators' that translate inputs into outcomes. *Inputs* concern the individual (e.g., athletes' skills), team (e.g., coach leadership), and environmental (e.g., organizational support) factors that can enable or constrain the interactions between team members (Mathieu et al., 2008). Finally, *outcomes* comprise individual and team consequences (e.g., performance, member satisfaction; Mathieu et al., 2008; McEwan & Beauchamp, 2014).

Since its development, the proposed relationships within the teamwork and team effectiveness model (McEwan & Beauchamp, 2014) have been tested in multiple studies. For example, cross-sectional research suggests that teamwork execution is positively related with variables such as social identification, psychological safety, and team resilience (Fransen, McEwan, et al., 2020). Moreover, McEwan (2020) found that athletes' perceptions of teamwork prospectively predicted their perceptions of group cohesion, collective efficacy, and satisfaction with their team's performance. More recently, López-Gajardo et al. (2022) tested these relationships (i.e., teamwork execution, group cohesion, collective efficacy, and perceived performance) using a longitudinal design, with measures at three timepoints during teams' seasons. Individual dimensions of teamwork have also been examined in relation to team outcomes. For instance, Lausic et al. (2009) found that winning women's tennis double teams demonstrated different communication patterns (e.g., more consistent sequences of

communication) compared to losing teams. Notwithstanding the contributions of these studies, at present, less is known about (a) whether teamwork execution does indeed have a *reciprocal* relationship with emergent states, and (b) the extent to which teamwork execution and emergent states act as mediators that translate inputs into outcomes *longitudinally*.

One prominent emergent state that has received attention in sport and is proposed to be related to teamwork in sport is *team resilience* (Fransen, McEwan, et al., 2020; Morgan et al., 2013, 2015, 2019). Considered an "intriguing new subject" within sport psychology (Eys et al., 2019, p. 41), team resilience has been conceptualized as a multifactorial, dynamic, and temporal state (Morgan et al., 2015) and defined as a "dynamic, psychosocial process which protects a group of individuals from the potential negative effect of the stressors they collectively encounter" (Morgan et al., 2013, p. 552). Based on previous research (Morgan et al., 2013), Decroos et al. (2017) developed a measure of team resilience, which comprised two subscales: characteristics of resilience (i.e., a team's ability to withstand and overcome problems) and vulnerability under pressure (i.e., the weaknesses that teams present in the face of adversities that they cannot successfully handle and overcome). The characteristics of resilience were proposed to be more closely related to "bright" interactions and positive collective beliefs (e.g., team unity), whereas the vulnerability under pressure factor was more strongly associated with "dark" problems, such as intra-team conflicts (Decroos et al., 2017). Despite the supposed relationships between teamwork execution and team resilience, studies that have examined these two variables together to date have adopted cross-sectional quantitative (Fransen, McEwan, et al., 2020) or qualitative (e.g., Morgan et al., 2013, 2019) research designs. Indeed, to the best of our knowledge, longitudinal studies quantifying the reciprocal relationships between teamwork execution and team resilience over time have not yet been conducted.

Based on the IMO framework (McEwan & Beauchamp, 2014), the bidirectional relationship between teamwork and team resilience can be both influenced by various inputs and lead to salient outcomes valued by sports teams. One input that is proposed to positively predict teamwork (Fransen, McEwan, et al., 2020; McEwan & Beauchamp, 2014) and team resilience (Morgan et al., 2013, 2015) is *athlete leadership quality*. The term 'athlete leader' can be used to describe athletes who hold a formal or informal leadership role within a team and impact how the team strives to achieve a shared goal (Loughead et al., 2006). Reflecting the multifaceted nature of athlete leadership, Fransen, Coffee, et al. (2014) built on earlier leadership classification systems (e.g., Loughead et al., 2006) by proposing a 4-factor categorization system for athlete leaders: (1) *task leaders* help the team to focus on their performance/task-related goals (e.g., making tactical decisions during gameplay, giving teammates advice during practice sessions); (2) *motivational leaders* encourage teammates to maximise effort exerted and perform at their best; (3) *social leaders* promote good relations within the team (e.g., helping newcomers build relationships in the team); and (4) *external leaders* link the players and individuals outside the team (e.g., club management, sponsors; Fransen, Coffee, et al., 2014; Loughead et al., 2006).

Although captains generally hold a formal leadership role within teams, captains do not always necessarily make the best leaders (Fransen, Vanbeselaere, et al., 2014) and it is recognized that athlete leadership can develop formally and/or informally (Cotterill et al., 2022). Therefore, whether the leader is formal or informal may not be as crucial as once thought; rather, it is the *quality* of leadership rather than the (in)formality of their leadership role that is essential to generate benefits for the team (Cotterill & Fransen, 2016). The quality of athletes' leadership has been defined as the extent to which player leaders fulfill their specific role effectively, impact team functioning, and are well-accepted by teammates (Fransen, Coffee, et al., 2014). This athlete leadership categorization has been found to be an

antecedent of teamwork execution in cross-sectional quantitative research (Fransen, McEwan, et al., 2020), as well as a psychosocial enabler of team resilience development in qualitative research (Morgan et al., 2019). To date, however, no longitudinal quantitative examinations of these variables have been conducted.

Finally, team performance is noted as a key outcome in the IMO framework (McEwan & Beauchamp, 2014) and is also one of the most studied team-level consequences across various contexts of team psychology (LePine et al., 2008; Mathieu et al., 2008). Within sport, this outcome has often been measured through athletes' perceptions of their team's performance as the samples in many studies include participants from an array of team sports (e.g., Al-Yaaribi et al., 2016; Davis et al., 2018; Fransen et al., 2017). Although evidence indicates that mediators such as teamwork execution (a team process; e.g., McEwan, 2020) and team resilience (an emergent state; e.g., Fransen, McEwan, et al., 2020) predict perceptions of team performance, those studies were limited by their cross-sectional nature. Indeed, no longitudinal examination of the relationship of an input, team process, and emergent state on team performance outcomes has yet been undertaken.

Aims and Overview of Current Research

The overarching aim of this research was to test predictions within the conceptual framework of teamwork and team effectiveness in sport (McEwan & Beauchamp, 2014). Two studies were conducted, with hypotheses for both studies based on the propositions of that framework as well as previous research on teamwork execution in relation to team resilience, athlete leadership, and team performance (Fransen, McEwan, et al., 2020; López-Gajardo et al., 2022; McEwan, 2020). Study 1 aimed to build on past research that examined the cross-sectional relationship between teamwork execution and the emergent state of team resilience. Accordingly, the purpose of Study 1 was to examine the reciprocal relationships between teamwork execution and team resilience over time. To do so, participating team sport athletes

completed measures of both variables at two timepoints within their competitive sport season. The following hypotheses were formed:

Hypothesis 1 (H1): Teamwork execution will positively predict characteristics of resilience (H1a) and negatively predict vulnerability under pressure (H1b) at the subsequent timepoint. Characteristics of resilience will positively predict teamwork execution at the subsequent timepoint (H1c), whereas vulnerability under pressure will negatively predict teamwork execution at the subsequent timepoint (H1d).

As discussed above, no study has yet examined teamwork execution in relation to an input, emergent state, and outcome over time. Thus, Study 2 aimed to explore the longitudinal relationships between athlete leadership quality, teamwork execution, team resilience, and perceived team performance. Study 2 included three timepoints, with athlete leadership measured at time 1 (T1), teamwork execution and team resilience measured at time 2 (T2), and perceived team performance measured at time 3 (T3). Three groups of hypotheses were proposed:

Hypothesis 2 (H2): Athlete leadership quality (i.e., task, social, motivational, and external) at T1 will positively predict teamwork execution (H2a) and characteristics of resilience (H2b) at T2 and negatively predict vulnerability under pressure (H2c) at T2.

Hypothesis 3 (H3): Teamwork execution and characteristics of resilience will positively predict perceived team performance at T3 (H3a and H3b, respectively), and vulnerability under pressure will negatively predict perceived team performance (H3c) at T3.

Hypothesis 4 (H4): Teamwork execution (H4a) and characteristics of resilience (H4b) and vulnerability under pressure (H4c) at T2 will mediate the relationship between athlete leadership quality (i.e., task, social, motivational, and external) at T1 and perceived team performance at T3.

Transparency and Openness

All data, procedures, ethical code, and other methods developed by the authors in both studies are appropriately cited in the text. The datasets generated and analysed during the current multi-study paper are available in the OSF repository (Study 1 at https://osf.io/p8kyg/; Study 2 at https://osf.io/fv84u/). Both datasets reported in this multi-study paper were part of a larger project examining the relationship between various group constructs in team sports during a season. The research questions addressed in Study 1 and Study 2 do not overlap with those addressed by other research questions. In addition, guided by the recommendations of Hox and McNeish (2020) for conducting multilevel regression models analyses, we sought a minimum sample size of 30 teams in both studies. The project (design, hypotheses, or analyses) was not preregistered.

Study 1

Method

Participants

A total of 1,566 athletes (1,094 men and 472 women) from 104 different teams in Spain aged 16 to 43 years old (M_{age} = 24.57 years, *SD* = 5.44) took part in the study. These athletes competed in professional (*n* = 421), semi-professional (*n* = 554), or amateur (*n* = 591) competitions and a range of sports, including soccer (*n* = 1164), basketball (*n* = 84), volleyball (*n* = 137), handball (*n* = 81), indoor soccer (*n* = 75), and rugby (*n* = 25). Team sizes ranged from 7 to 31 athletes per team, with an average of 15 athletes per team (*SD* = 3.40). From the total athletes included in Study 1, 542 (34.61%) were newcomers at the beginning of the season, 723 athletes (46.18%) had been members of their team for 2-5 consecutive seasons prior to data collection, and 301 athletes (19.22%) had been members of their team for more than five consecutive seasons.

Instruments

Teamwork execution. Athletes completed the execution subscale from the Multidimensional Assessment of Teamwork in Sport (MATS; McEwan et al., 2018). This subscale has a total of 13 items divided into three sections: communication (five items; e.g., "Team members communicate at the appropriate times"), cooperation (four items; e.g., "Members do anything that is necessary for the team's benefit"), and coordination (four items; e.g., "Overall, team members coordinate actions well with each other"). Each item is scored on a 7-point Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Higher scores indicated higher levels of perceived teamwork execution in the team. The Spanish version of the MATS previously adapted by López-Gajardo et al. (2022) with Spanish athletes was used. A Hierarchical Confirmatory Factor Analysis (HCFA) showed acceptable model fit (see Supplemental Table 1).[1] Values demonstrated adequate levels of internal consistency (Knapp & Mueller, 2010; Nunnally & Bernstein, 1994) for the full scale (see Table 1).

Team resilience. The Spanish version of the Characteristics of Resilience in Sports Teams Inventory (CREST; Decroos et al., 2017) validated by López-Gajardo et al. (2021) was used to measure team resilience. This instrument starts with a stem phrase (e.g., "In the last month when my team was under pressure..."), followed by a total of 20 items grouped into two factors: characteristics of resilience (12 items; e.g., "the team gained confidence by working together to overcome pressure") and vulnerability under pressure (eight items, e.g., "the team couldn't resist at the most difficult times"). Responses are rated on a 9-point Likert-type scale ranging from 1 (*totally disagree*) to 7 (*totally agree*). The Confirmatory Factor Analyses (CFA) with two main factors showed adequate model fit (see Supplemental Table

[1] Scores greater than .90 for the incremental indexes of CFI and TLI (Bentler & Bonett, 1980; (Bentler & Bonett, 1980; Schumacher & Lomax, 1996) and values less than .06 for the RMSEA and .08 for the SRMR (Hu & Bentler, 1999) were considered acceptable.

1). Similarly, adequate values of internal consistency for characteristics of resilience and vulnerability under pressure were obtained (see Table 1).

Procedure

In line with the Declaration of Helsinki of 1964, the ethics committee from the first author's university approved the study and the American Psychological Association's ethical standards were followed. This study followed a longitudinal design, with both variables (i.e., teamwork execution and team resilience) assessed at two timepoints during the competitive sport season: T1 was at the start of the season in November; T2 was at the middle of the season in January-February. The T1 survey was distributed four weeks into the season to allow group members to familiarize themselves with each other and gain experience working together. Data were collected approximately two months apart (mean time between T1 and T2 = 66.2 days). To recruit participants, the coaches were contacted and provided with information about the study and asked to facilitate recruitment of players. Coaches who agreed to support the study allowed the research team to attend a training session to enable the athletes to partake. After reading a participant information sheet, all participants provided written consent to take part. For athletes under the age of 18, their parent or guardian provided informed consent. Participants completed the questionnaires electronically with their mobile phones in a quiet room and before a training session to ensure they were not fatigued and had a suitable environment to concentrate during data collection. The questionnaires were completed under the supervision of research assistants and took 12–17 minutes to complete.

Various procedural remedies were employed to account for endogeneity bias (i.e., common method variance or omitted selection; Antonakis et al., 2010; Podsakoff et al., 2012). To minimize the extent of common method bias we used a temporal separation of data collection (i.e., multiple timepoints), standardized scales with different ranges, and reminded athletes that their participation was voluntary and their responses would be anonymous. To

address potential omitted selection, we aimed to obtain a sample that was representative of the team sports practiced in the country (namely from a range of team sports, geographical regions, competitive levels, and genders) and also treated all participants and teams equally (e.g., same recruitment and data collection procedures for every team). Missing data from participants were addressed using mean imputation, which is a suitable and conservative method of item replacement that can be used when small portions of data are missing (Field, 2009; Tabachnick & Fidell, 2001). Moreover, participants who had large amounts of missing data (i.e., more than 50% of the items were unanswered; Leo et al., 2019) were removed entirely from the final sample. Missing data were minimal and sporadic, with only 12 participants removed from the final dataset.

Data analysis

Data were analyzed using Mplus version 7.3 (Muthén & Muthén, 1998–2019). After conducting preliminary analyses to test the validity and reliability of data within each measure (see Table 1), we calculated descriptive statistics (means, standard deviations, and bivariate correlations) for all variables included in the study. As a complement, the Heterotrait-Monotrait (HTMT) Ratio of Correlations test was carried out to evaluate discriminant validity and statistical overlap between teamwork execution and characteristics of resilience (Hamid et al., 2017). Moreover, to address potential endogeneity and common method bias (Antonakis et al., 2010), we conducted Harman's single factor test (Podsakoff et al., 2012). Considering the nested nature of teams (Chan, 1998) and the team-level constructs under investigation, it is necessary to analyze our hypotheses from an individual and group perspective and test the relationships between teamwork execution and team resilience at multiple levels (i.e., within and between teams).[2] Specifically, two independent, multilevel structural equation models

[2] We specified several null models for teamwork execution and team resilience to calculate the intraclass correlation coefficient (ICC). ICC values greater than 10% indicate the total amount of variance in a given variable of interest that is due to group-level effects (see Table 1; Hox, 2010).

(MSEM) were developed to simultaneously examine the relations at the player level and team level. Developing these MSEM through a longitudinal design also helped to reduce the endogeneity bias (i.e., the inconsistent inference; Podsakoff et al., 2012). Fixed effects were included because random slopes may lead to convergence difficulties, decreasing the probability of convergence (Preacher et al., 2010), particularly in models using latent variables (Sadikaj et al., 2021). Nevertheless, as pointed out by Preacher et al. (2010), "the use of slopes that combine Between and Within effects can easily lead to indirect effects that are biased relative to their true values, because the component paths may conflate effects that are relevant to mediation with effects that are not" (p. 210). Therefore, the MSEM approach was preferable to multilevel regression because it can better accommodate multivariate models with several variables in the same model (e.g., Preacher et al., 2010). Moreover, robust maximum likelihood (MLR) estimation was used, as this estimator is robust to non-normality (Muthén & Muthén, 1998–2019; Yuan & Bentler, 2000). To facilitate interpretation of the results, we used Cohen's (1988) guidelines for effect sizes, labelling values as small (.01), medium (.09), or large (.25). These effects were regarded as significant if the resulting 95% confidence intervals did not span zero.

Results

Preliminary analyses

First, Table 1 shows the means, standard deviations, reliability analysis, ICCs, and bivariate correlations of the study variables. With respect to the correlations, participants reported significant and positive relationships between teamwork execution and characteristics of resilience at T1 and T2 (r = .30 − .80; ps < .001). Additionally, teamwork execution and characteristics of resilience showed a negative association with vulnerability under pressure at both timepoints (r = -.21 − -.57; ps < .001). Second, the HTMT Ratio tested between variables ranged from .31 to .85 (see Supplemental Table 2). Therefore, the values obtained in Study 1

are below the threshold of .90 suggested by Gold et al. (2001) and Hamid et al. (2017). Third, Harman's single-factor test revealed that a single factor accounted for 35.74% of the total variance, which is less than the suggested value (< 50%; Harman, 1967), indicating that the common method bias was nonsignificant. Therefore, common method bias was likely not an issue in this study.

****Table 1 near here****

Main analysis

The results of H1 are provided in Figure 1. In line with H1a and H1c, a reciprocal and positive relationship was found between teamwork execution and characteristics of resilience at the player level across the season (β = .12 − .12; p = .012 − .049; 95% CI [.02, .21 − .00, .22]). At the team level, however, despite our findings showing a large, significant, and positive relationship at the same timepoint (r = .85 − .95; ps < .001), the reciprocal associations between teamwork execution and characteristics of resilience (β = -.05; p = .827; 95% CI [-.55, .65]) and vice versa (β =.12; p = .644; 95% CI [-.40, .44]) across the season were not statistically significant (see Figure 1).

In line with H1b and H1d, at the player level, the results showed a reciprocal and negative relationship between teamwork execution and vulnerability under pressure over season (β = -.12 − -.14; ps < .001; 95% CI [-.18 − -.06, -.23 − -.06]). At the team level, however, the reciprocal relationship between teamwork execution and vulnerability under pressure at T1 and T2 were non-significant (β = -.55 − -.68; p = .121 − .082, 95% CI [-1.47, .08 − -1.44, 1.25]).

****Figure 1 near here****

Study 1 Summary

In Study 1, greater athlete perceptions of teamwork execution predicted greater perceptions of characteristics of resilience and lower vulnerability under pressure two months

later on average in their season. Additionally, players who perceived greater characteristics of resilience and lower vulnerability under pressure in their teams also perceived greater teamwork execution at T2. These findings support H1 at the player level and align with previous theoretical predictions (McEwan & Beauchamp, 2014) of a reciprocal relationship between teamwork execution (a team process) and team resilience (an emergent state). Although the relationships from T1 to T2 between teamwork execution and team resilience were non-significant at the team level, it should be noted that the strength of the relationships were often moderate-to-strong. Considering the sample entered into the team-level MSEM (i.e., n = 104 teams) was much smaller compared to the individual-level MSEM (i.e., n = 1,566 athletes), it is possible that the absence of statistically significant results may be due to the relatively smaller sample size at the team level.

Study 1 generated preliminary evidence concerning the reciprocal relationship between teamwork execution and team resilience (at the player level, that is) and, thus, adds to the knowledge base regarding the IMO framework within the teamwork in sport model (McEwan & Beauchamp, 2014). Nevertheless, our findings were limited to the relationship between teamwork execution and the emergent state of team resilience and did not include measures of any inputs or outcomes from the IMO model (McEwan & Beauchamp, 2014). Thus, further research is needed to examine all aspects of the IMO framework during a competitive season (i.e., input, mediator, emergent states, and output), which is a notable gap in the existing literature. Furthermore, to develop a deeper understanding of the relationships between inputs (namely, athlete leadership quality) and outcomes (namely, team performance), it is necessary to test the potential mediating effects between these constructs over time. Doing so would offer new insights into the mechanisms that explain the relationship between athlete leadership and perceived team performance, including the mediating role of teamwork execution and team resilience.

Study 2

Method

Participants

A total of 1,117 athletes aged between 16 and 43 years (M_{age} = 24.75, *SD* = 5.62) from 92 senior teams participated in Study 2. The participants were men (*n* = 754; *M* = 25.83, *SD* = 5.45) or women (*n* = 363; *M* = 22.49, *SD* = 5.31) athletes who competed in soccer (*n* = 848), volleyball (*n* = 84), handball (*n* = 61), indoor soccer (*n* = 59), basketball (*n* = 44), and rugby (*n* = 21). The competition level of the teams ranged from the top division to the third division of regional-level competitions in Spain (professional *n* = 279; semi-professional *n* = 397; amateur competitive level *n* = 441). Team sizes ranged from 6 to 23 players per team (*M* = 12.3, *SD* = 5.20). In relation to team tenure, 353 athletes (i.e., 31.60%) were newcomers at the beginning of the season, 541 athletes (i.e., 48.33%) had been members of their team for 2-5 consecutive season, and 223 athletes (i.e., 19.96%) were members of their teams for more than five consecutive seasons.

Instruments

Perceived leadership quality. We examined leadership quality grounded in the 4-factor model of athlete leadership (i.e., task, motivational, social, and external leaders, see Fransen, Coffee, et al., 2014). Accordingly, after reading the definitions of each role, the athletes selected the teammate or teammates (including themselves as an option) that they considered as a type of leader (task, social, motivational, or external). The athletes then rated their perceptions about the leadership quality of each role of their teammates selected by responding to the following item, “To what extent do you think that this/these leader/s fulfills his/her role/s as leader well?”. Players responded to four items on 11-point Likert scales, ranging from 0 (*very poor leader*) to 10 (*very good leader*). For reasons of model parsimony, and in line with previous research (e.g., Fransen, Coffee, et al., 2014; López-Gajardo, Pulido,

et al., 2021), we created a composite score of overall athlete leadership quality. The perceived quality of each of the four different leadership roles contributed to an overall measure of perceived athlete leadership quality ($\lambda = .68 - .81$). The CFA established with the overall measure of perceived athlete leadership quality showed an appropriate fit (see Supplemental Table 1). The internal consistency values were adequate (see Table 2).

Teamwork execution and team resilience. These instruments were the same as those used in Study 1. With regard to data validity and reliability, appropriate fit (see Supplemental Table 1) and adequate internal consistency (see Table 2) was evident for data derived from both measures.

Perceived team performance. To assess perceived team performance, we asked participants to rate their team's performance through a single-item scale. Athletes' perceptions of team performance have been previously used to analyze team performance in group dynamics research (Davis et al., 2018; Fransen et al., 2017; Leo et al., 2019) and are considered to be an ecologically valid and reliable measure to assess this variable in team sports (Tenenbaum & Gershgoren, 2011). Within our study, athletes were asked to rate their team's performance in the season (e.g., "the team's performance during the season has been..."), with ratings on 10-point Likert scale, ranging from 1 (*poor*) to 10 (*excellent*).

Procedure

The procedures used in Study 1 were replicated in Study 2 for participant recruitment, data collection (e.g., in-person, before training), and handling of potential endogeneity bias (Antonakis et al., 2010; Podsakoff et al., 2012). A longitudinal design with three timepoints was used (*M* time between timepoints = 82.6 days). Specifically, T1 was at the start of the season (November), T2 was in the middle of the season (January-February), and T3 was at the end of the season (April-May). Surveys at all three timepoints were completed electronically with mobile phones under the supervision of research assistants and included demographic

questions and a measure of the respective variable(s) for that timepoint. Thus, athletes completed the measure of perceived athlete leadership quality at T1, teamwork execution and team resilience at T2, and their perception of their team's performance over the season at T3. Again, missing data were addressed in the same way as Study 1.

Data analysis

Data were analysed using Mplus 7.3 (Muthén & Muthén, 1998–2019). Initially, factorial validity, descriptive analyses, reliability, and bivariate correlations were performed. Similar to Study 1, the nested structure of the dataset (i.e., athletes are nested within teams; Hox, 2010) and potential endogeneity bias (Podsakoff et al., 2012) were taken into account. The HTMT range ratio and Harman's single factor were again tested in Study 2. MSEM was performed to test relationships between the study variables over time whilst controlling for the group-level effects. We again used the MLR estimation (Yuan & Bentler, 2000) and the guidelines provided by Cohen (1988) to facilitate interpretation of the results. The model constraint command was used to estimate the within- and between-indirect effects. In addition, a secondary analysis with a latent common factor including the teamwork execution and team resilience variables (Time 2) was used to further control for possible common method bias.

Results

Preliminary analyses

First, means, standard deviations, internal reliability coefficients, ICCs, and bivariate correlations among the study variables are presented in Table 2. The results from the correlation analyses demonstrated significant and positive associations between athlete leadership quality at T1, teamwork execution and characteristics of resilience at T2, and perceived team performance at T3, respectively (r = .15 − .80; ps < .001). Conversely, significant, negative relationships (r = -.19 − -.57; ps < .001) were found between

vulnerability under pressure at T2 and all other psychological variables (i.e., athlete leadership quality at T1, teamwork execution and characteristics of resilience at T2, and perceived team performance at T3). Second, the HTMT range ratio obtained between variables in Study 2 were below the threshold of .90 (see Supplemental Table 2; Gold et al., 2001; Hamid et al., 2017). Third, Harman's single factor test (35.20% of the total variance) was below the 50% threshold (Harman, 1967). Taken together, we deemed it unlikely that common method bias was an issue in this study.

****Table 2 near here****

Main analysis

MSEM was used to test H2, H3, and H4. The results of this model are represented in Figure 2.[3] The model showed adequate fit at both levels: $\chi^2 = 56.899$, $df = 30$, $p = .002$, CFI = .99, TLI = .98, RMSEA = .02, $SRMR_{player} = .03$, $SRMR_{team} = .06$. The common latent factor did not improve the model fit with respect to this previous original hypothesized MSEM: $\chi^2 = 112.207$, df = 27, $p < .000$, CFI = .96, TLI = .95, RMSEA = .03, $SRMR_{player} = .04$, $SRMR_{team} = .31$. This suggests that the results of the hypothesized model were not affected by the common method bias within the observed data, relationships among the variables were not due to self-report bias, and the intercorrelations between variables did not affect the model.

Regarding H2, athlete leadership quality positively predicted teamwork execution ($\beta = .29$; $p < .001$, 95% CI [.19, .40]) and characteristics of resilience ($\beta = .32$; $p < .001$, 95% CI [.20, .44]), and negatively predicted vulnerability under pressure ($\beta = -.21$; $p < .001$, 95% CI [.14, .24]) at the player level. At the team level, athlete leadership quality positively predicted teamwork execution ($\beta = .44$; $p = .001$, 95% CI [-.29, -.13]) and characteristics of resilience ($\beta = .40$; $p = .001$, 95% CI [.18, .71]); however, the negative association between athlete

[3] We also included each athlete leadership quality role at T1 (i.e., task, social, external, and motivational role) as individual predictors to test the same model showed in Figure 2 (see Supplemental Table 3).

leadership quality and vulnerability under pressure was not significant (β = -.24; p = .110, 95% CI [-.55, .05]).

With regard to H3, teamwork execution at T2 significantly and positively predicted perceived team performance at T3 at the player level (β = .21; p = .001, 95% CI [.08, .33]). However, neither characteristics of resilience (β = .04; p = .540, 95% CI [-.09, .18]) nor vulnerability under pressure (β = -.03; p = .550, 95% CI [-.12, .06]) were statistically significant predictors of perceived team performance at the player level. Moreover, although the path coefficients at the team level for teamwork execution (β = .47; p = .354, 95% CI [-.52, 1.45]), characteristics of resilience (β = .22; p = .730, 95% CI [-1.48, 1.03]), and vulnerability under pressure (β = -.32; p = .263, 95% CI [-.88, .24]) in relation to perceived team performance were all larger compared to the athlete-level associations, none of these team-level relationships were statistically significant.

****Figure 2 near here****

Regarding H4 (mediation) at the player level, perceived athlete leadership quality (T1) had a significant, indirect role—to a small extent—on perceived team performance (T3) via teamwork execution at the player level (T2; β = .07, p = .004, 95 % CI [.01, .05]). The indirect effects of athlete leadership quality on perceived team performance via characteristics of resilience (β = .00, p = .702, 95 % CI [-.02, .03]) or vulnerability under pressure (β = .00, p = .843, 95 % CI [-.05, .06]) were not significant at the player level. Moreover, at the team level, teamwork execution (β = .72, p = .301, 95 % CI [-.64, 2.08]), characteristics of resilience (β = .19, p = .470, 95 % CI [-.33, .70]), or vulnerability under pressure (β = -.24, p = .732, 95 % CI [-1.61, 1.29]) were not significant mediators of the athlete leadership quality – perceived team performance relationship.[4]

[4] We also included each athlete leadership quality role at T1 (i.e., task, social, external, and motivational role) to test individually the mediating effects with predicted perceived team performance (T3), via teamwork execution and team resilience (T2). Due to space restrictions, there are included in Supplemental Table 4.

Study 2 Summary

Overall, in Study 2, the players who perceived higher levels of athlete leadership quality in the team, also reported higher values for teamwork execution and characteristics of resilience (at the player- and team-level) and lower values in vulnerability under pressure (at the player level). These findings support H2a, H2b at player and team levels, and H2c at the player level (H2c was not supported at the team level). In addition, only teamwork execution showed a significant and positive relationship with perceived team performance (at the player level only). These results, therefore, partially support H3 (i.e., only support H3a, therefore H3b and H3c were not supported). Finally, only teamwork execution acted as a significant mediator between athlete leadership quality and perceived team performance (at the player level). As such, partial support was demonstrated for H4 (i.e., H4a at the athlete level; H4b and H4c were not supported).

General Discussion

This multi-study paper presented two longitudinal studies testing the conceptual framework of team effectiveness in sport (McEwan & Beauchamp, 2014), with a particular focus on teamwork execution and team resilience. In Study 1, we sought to examine the reciprocal relationships between teamwork execution and team resilience within sports teams at two timepoints in a competitive season. In Study 2, we analyzed the association between athlete leadership quality (T1) with teamwork execution and team resilience (T2) and, in turn, the relationship between teamwork execution and team resilience with perceived team performance (T3). Overall, we found partial support for our a priori hypotheses. In this section, we discuss the results related to both studies and the implications of our findings for existing literature and applied practice.

Regarding Study 1, athlete-level perceptions of teamwork execution shared a bidirectional and positive relationship with characteristics of resilience perceptions as well as

a negative bidirectional relationship with vulnerability under pressure perceptions over the season, thereby supporting H1a, H1b, H1c, and H1d at the player level. Hence, our results showed that players who believed that their teammates coordinate actions well, work together effectively, and communicate well reported their team also viewed their team as more resilient and less vulnerable under pressure during the season (and vice versa). This study adds to the body of evidence on teamwork and team resilience to date (Fransen, McEwan, et al., 2020; López-Gajardo et al., 2022; McEwan, 2020) and extends this evidence base from a methodological and theoretical perspective. Specifically, the findings support the reciprocal team process – emergent state relationship proposed within the model of team effectiveness in sport (McEwan & Beauchamp, 2014). Indeed, by testing both teamwork execution and resilience at multiple timepoints, our findings suggest that the relationship between these variables is exhibited longitudinally and that those relationships are indeed reciprocal over time at the player level. That said, greater teamwork perceptions at the team level was not associated with significatively higher perceived characteristics of resilience and lower vulnerability under pressure, or vice versa. These findings may be due to the relatively smaller sample size at the team versus individual level (as the effect sizes were typically similar at both levels) but could also possibly be explained by the intra-team variability in perceptions of teamwork and team resilience variables—that is, the aggregate scores at the team level can balance the range of perceptions within the group. For example, higher ratings of characteristics of resilience by some players could offset low ratings given by other players.

In Study 2, our findings supported H2a and H2b at player and team levels, and H2c at the player level (i.e., H2c at the team level was not supported). That is, athlete leadership quality perceptions (i.e., task, social, motivational, and external) at the beginning of the season had a positive association with teamwork execution and perceived characteristics of

resilience as well as a negative relationship with perceived vulnerability under pressure in the middle of the season. In other words, when athletes believed that their team had high-quality athlete leaders, they appeared to be more likely to have higher perceptions of teamwork execution behaviors (i.e., coordination, communication, cooperation) as well heightened player perceptions of the team's ability to overcome adversity and be less vulnerable under pressure. This evidence builds on previous cross-sectional evidence concerning the relationships of athlete leadership with both teamwork execution and team resilience (Fransen, McEwan, et al., 2020; Morgan et al., 2013, 2015). Specifically, our study suggests that one way to foster effective teamwork execution and team resilience in sport is to develop quality athlete leadership. Similarly, based on findings at the team level, teams perceiving more high-quality athlete leadership within their teams are more likely to subsequently report better perceptions of teamwork and characteristics of resilience. However, even if teams perceive high-quality athlete leadership within their team, our findings suggest that it does not seem to help them to be less vulnerable to obstacles, conflicts, or adversity as a team. Consequently, this highlights the complexities of group dynamics and suggests that alternative factors (see Morgan et al., 2013) may be more important for reducing such vulnerability under pressure in teams.

Related to the H3a, H3b, and H3c, which focused on the relationship between teamwork execution and team resilience perceptions with perceived team performance, the results revealed that only the perceptions of teamwork execution in the middle of the season had a significant and positive association with perceived team performance at the end of the season, partially supporting the H3 at player level (i.e., H3b and H3c were not supported). Therefore, the present longitudinal findings compliment previous studies that demonstrated relationships between teamwork (including teamwork execution specifically) and satisfaction with individual and team performance (Fransen, McEwan, et al., 2020; López-Gajardo et al.,

2022; Marks et al., 2001; McEwan, 2020). Ultimately, our findings appear to support the idea that if a team seeks to improve team performance at the end of the season, it is essential to develop strong teamwork execution behaviors during the season. Contrary to expectations, however, perceptions of team resilience (i.e., characteristics of resilience and vulnerability under pressure) in the middle of the season did not have a significant association with perceived team performance at the end of the season. Given that team resilience has been proposed to be important for long-term success in teams (Morgan et al., 2019), these findings could be interpreted as somewhat surprising. It should be noted that the correlational relationships between perceived performance and both characteristics of resilience (r = .31, p < .001) and vulnerability under stress (r = -.26, p < .001) were in the expected direction. Therefore, it is possible that team resilience at T2 was not significantly associated with perceived team performance at T3 because team resilience might take longer to impact perceived performance than a behavioral construct (e.g., teamwork). Again, this evidence underscores the complexity of group dynamics in sport and further research is needed to better understand the intricacies of the relationship between these variables over time.

Lastly, guided by the IMO framework from the teamwork model in sport (McEwan & Beauchamp, 2014), the H4a, H4b, and H4c proposed that perceived teamwork execution, characteristics of resilience and vulnerability under pressure at T2 would mediate (respectively) the relationship between athlete leadership quality at T1 and perceived team performance perceptions at T3. However, only teamwork execution significantly mediated (in the positive direction) the association between athlete leadership quality at T1 and perceived team performance at T3. Thus, H4a was supported at the player level but not the team level and H4b and H4c were not supported at either the player or team level. These results suggest that if players perceive good athlete leadership quality at the start of the competition, this may lead to greater perceptions of team performance at the end of the season, and that a potential

explanation for this relationship is that higher perceptions of athlete' leadership quality result in better coordination, cooperation, and communication between teammates in the middle of the season. Therefore, the current study offers a potential mechanism to explain previous evidence indicating that higher perceptions of athlete leadership quality are related to perceived team performance (Fransen et al., 2017). In contrast, as previously pointed out in H1, the intra-team variability within teams could affect the relationship between variables at the team level (hypotheses H3b, H3c, H4b, and H4c were not supported at the team level). Finally, emergent states, such as team resilience, might not have an indirect role between inputs and outputs (i.e., H4b and H4c). As discussed previously, it is possible that behavioral variables (such as teamwork) may be more likely to facilitate performance compared to cognitive, affective, or motivational states (i.e., emergent states such as team resilience). Of course, caution is necessary in interpreting the findings of a single study; in any case, more research is clearly necessary to better elucidate the extent to which team processes and emergent states prospectively predict team performance outcomes in sport.

Strengths, Limitations and Future Research

The two studies presented in this paper advance understanding of team effectiveness in sport. A notable strength of this work is that it includes the first study (to our knowledge) to test the entire IMO framework—that is an input, team process, emergent state, and outcome variable—within one statistical model through longitudinal design at two levels of analysis (i.e., player and team level). Moreover, compared to previous research on teamwork, a larger sample size (particularly at the athlete level) was obtained for both studies. These two features allowed us to examine the proposed reciprocal relationships (i.e., between teamwork execution and team resilience) and longitudinal mediating relationships (i.e., between athlete leadership, teamwork execution, team resilience, and perceived team performance) using contemporary data analysis techniques that are necessary for team research (i.e., multilevel structural equation modeling).

Despite the novel insights provided, a number of limitations need to be noted when interpreting the findings. First, the most important limitation lies in the fact that, although we employed a longitudinal design with two measurements in Study 1 and three measurements in Study 2 across the playing season, causal relationships cannot be inferred from the current study. Therefore, further experimental or quasi-experimental investigations are needed to provide more evidence about mechanisms that facilitate teamwork execution and team resilience and their potential outcomes. Second, the lower number of units/clusters at a team-level for the MSEM analysis (approximately 100 for each study) compared to the individual-level, could have undermined the statistical power of the study and the results at the team level (e.g., Hayes, 2006; Snijders, 2005). Thus, in future research, a larger number of teams may be needed for adequate power at the team level, although we certainly appreciate the difficulty and considerable amount of time and resources that are likely required to carry out such research. In this regard, Shi et al. (2019) recommended that a sample size of 500 units/clusters at a team-level is required to obtain adequate model convergence and statistical power. Third, although data from each measure showed adequate validity and reliability, all variables were measured only using the players' perceptions and composite scores for some variables (e.g., teamwork execution, leadership quality). Furthermore, we only included the execution dimension of teamwork. In addition, perceptions of team performance only included a single item. Therefore, future research could include other forms of measurement (e.g., observational methods for teamwork, objective metrics/statistics for team performance) and examine other (or all) aspects of teamwork. Such research would help offset potential common method variance that may be present beyond the steps already taken in this study (that is, to measure variables at multiple timepoints; Podsakoff et al., 2012).

Applied Implications

From an applied perspective, the findings could have several implications. For one, coaches and practitioners should take advantage of the bidirectional association between teamwork execution and team resilience and attempt to promote a higher level of teamwork execution and/or team resilience from the beginning of the season. In particular, to promote the development of characteristics of resilience, each characteristic, process, and enabler should be addressed to overcome or cope with the problems that occur over the course of a season (Morgan et al., 2013, 2015, 2019). In addition, practitioners and coaches should also pay attention to vulnerability under pressure by creating pressure situations during training that provide players with opportunities to practice teamwork execution in simulated pressure contexts. Such efforts would appear to not only help develop team resilience but would also benefit the team's communication, coordination, and cooperation over time. Moreover, teamwork execution itself could be directly targeted by coaches as a means of supporting the development of team communication, coordination, and cooperation, which, in turn, could enhance both team resilience and team performance. Based on existing research (McEwan & Beauchamp, 2014; McEwan & Crawford, 2022), this could include strategies such as: team discussions around what effective teamwork execution looks like specifically within their team; creating game simulations during training sessions and pre-game warmups to help team members prepare for teamwork execution; simple and specific action plans during in-match transitions (e.g., timeouts, halftime/period breaks); and helping players develop emotion management strategies (e.g., interpersonal emotion regulation; Tamminen et al., 2021) to employ during gameplay.

Teamwork execution, team resilience, and team performance could also be facilitated over time by promoting high-quality athlete leadership in the team. Our findings suggest that this may be particularly important at the start of teams' seasons when they are in the early stages of their development. This underscores the importance of identifying (at least some) athlete

leaders at the beginning, whether those players are returning from previous seasons with the team or are new players to the team. Coaches may also be well served to avoid a hierarchical structure that exists in a vertical leadership and, instead, cultivate shared leadership in their teams (Fransen et al., 2017; Leo et al., 2019). Moreover, knowing that "leaders are not just born, but can also be made" (Fransen, Haslam, et al., 2020, p. 1), coaches should invest time and energy into developing the leadership qualities of the athletes in their teams. This could include creating formal leadership roles (e.g., assigning task leaders and assisting them with their leadership behaviors on the field) and allowing other roles (e.g., social leaders) to emerge more informally and organically.

Conclusion

In summary, these findings provide evidence of the longitudinal relationships between inputs, processes, emergent states, and outcomes. Specifically, it was shown that teamwork execution is reciprocally and longitudinally associated with team resilience. Moreover, creating high-quality athlete leadership at the start of the season could improve teamwork execution and team resilience at the middle of the season. In turn, our findings suggest that teamwork execution may act as a mechanism that translates effective athlete leadership into subsequent perceptions of team performance.

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Table 1

Descriptive Results, Alpha and Omega values, Intraclass Correlations, and Bivariate Correlations of the Target Variables in Study 1

Variables	*M*	*SD*	α	ω	ICC	1	2	3	4	5
Time 1										
1. Teamwork execution	5.41	.87	.93	.93	.19	-				
2. Characteristics of resilience	5.64	.88	.91	.91	.15	.75***	-			
3. Vulnerability under pressure	2.83	1.26	.87	.88	.13	-.38***	-.53***	-		
Time 2										
4. Teamwork execution	5.36	.91	.95	.95	.20	.39***	.34***	-.27***	-	
5. Characteristics of resilience	5.52	.95	.93	.93	.21	.30***	.33***	-.25***	.80***	-
6. Vulnerability under pressure	2.96	1.31	.89	.89	.23	-.21***	-.27***	.33***	-.47***	-.57***

Note. ***$p < .001$.

Table 2

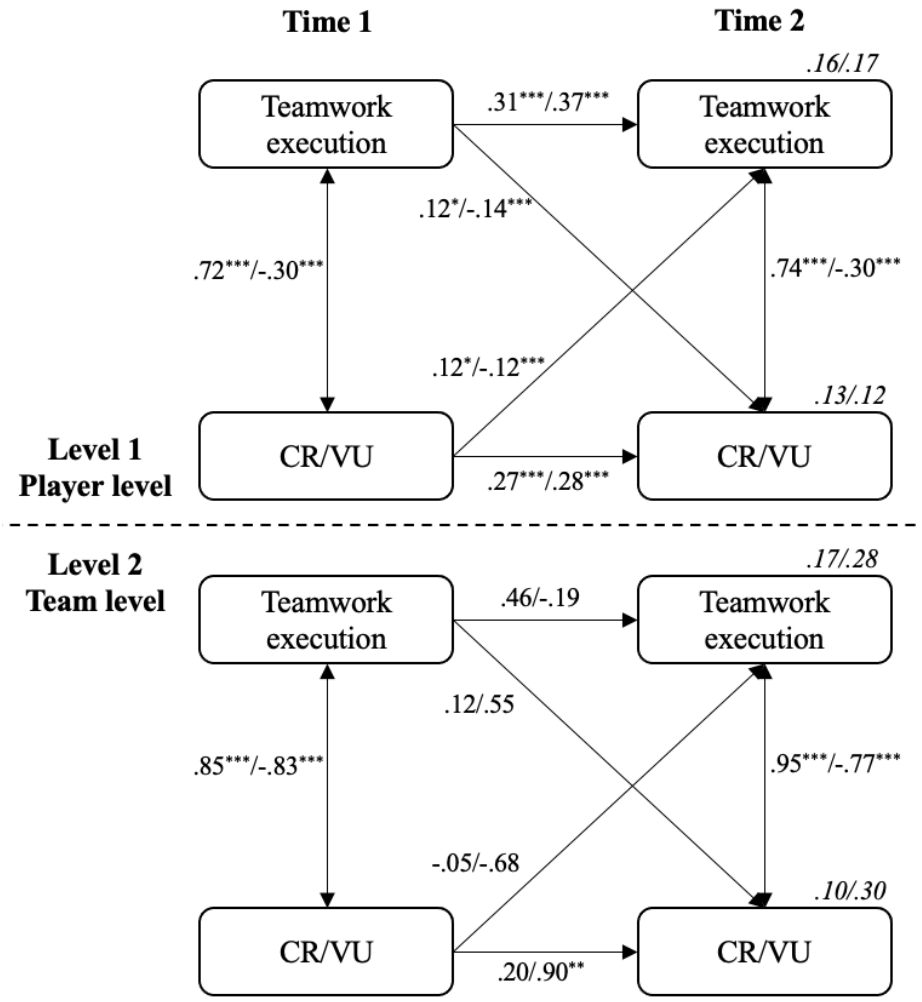
Descriptive Results, Alpha and Omega values, Intraclass Correlations, and Bivariate Correlations of the Target Variables in Study 2

Variables	*M*	*SD*	α	ω	ICC	1	2	3	4	5
1. Athlete leadership quality at Time 1	8.45	1.30	.83	.83	.19	-				
2. Teamwork execution at Time 2	5.36	.92	.95	.95	.20	.28***	-			
3. Characteristics of resilience at Time 2	5.52	.95	.93	.93	.21	.30***	.80***	-		
4. Vulnerability under pressure at Time 2	2.95	1.31	.89	.89	.23	-.19***	-.47***	-.57***	-	
5. Perceived team performance at Time 3	7.63	1.68	-	-	.46	.15***	.35***	.31***	-.26***	-

Note. ***$p < .001$.

Figure 1

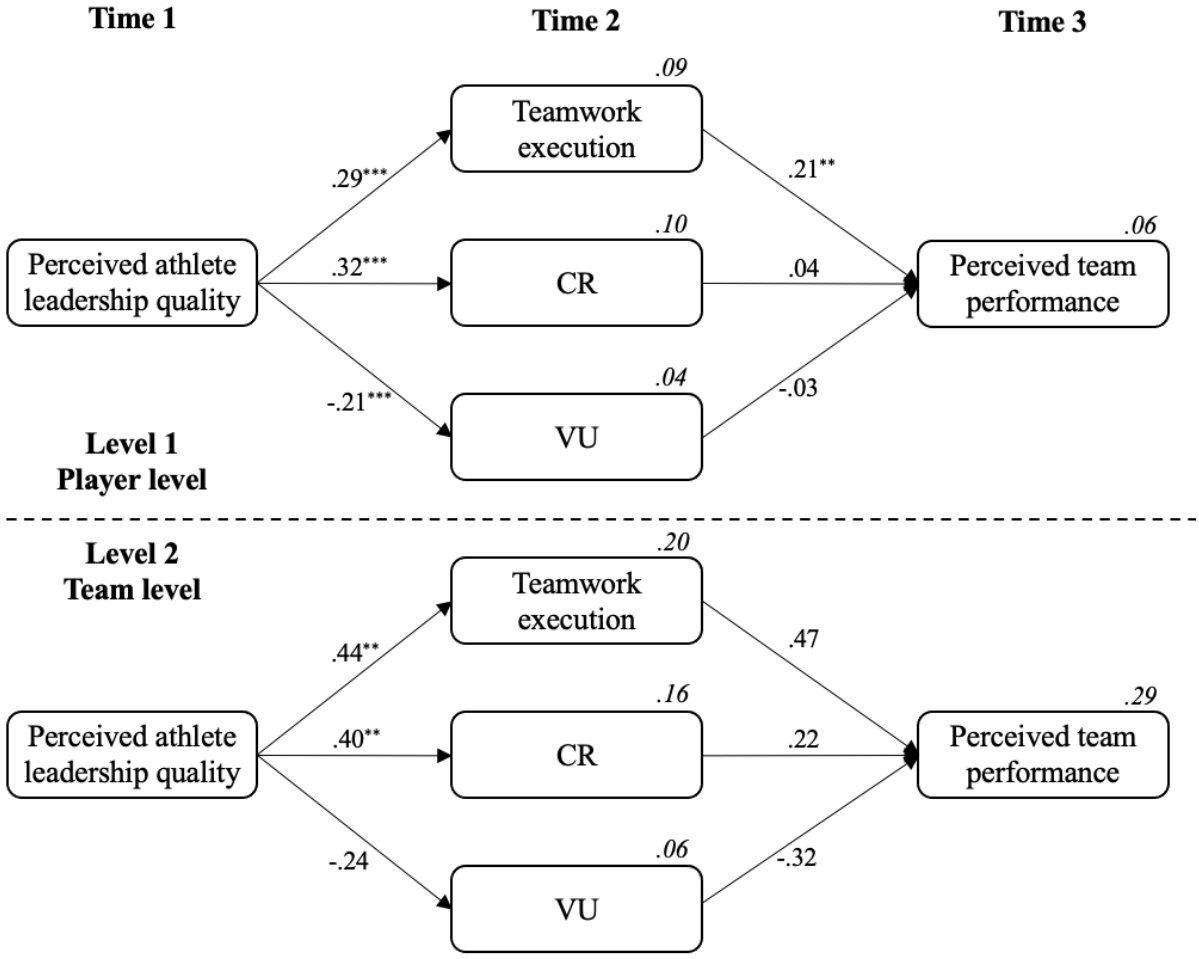
MSEM examining Reciprocal Relationships between Teamwork execution and Characteristics of Resilience (first coefficient) and Vulnerability Under Pressure (second coefficient) in Study 1



Note. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$. Proportions of explained variance are presented in italics. All coefficients presented are standardized. MSEM = Multilevel structural equation model; CR = Characteristics of resilience; VU = Vulnerability under pressure.

Figure 2

MSEM of the Relationship between Perceived Leadership Quality (at T1), Teamwork execution (at T2), Characteristics of Resilience (at T2), Vulnerability Under Pressure (at T2), and Perceived Team Performance (at T3) in Study 2



Note. $^{***}p < .001$, $^{**}p < .01$. Proportions of explained variance are presented in italics. All coefficients presented are standardized. MSEM = Multilevel structural equation model; CR = Characteristics of resilience; VU = Vulnerability under pressure. Not shown (for reasons of clarity): the relations between teamwork execution and characteristics of resilience ($r = .74$, $p < .001$ at player level; $r = .93$, $p < .001$ at team level), teamwork execution and vulnerability under pressure ($r = -.34$, $p < .001$ at player level; $r = -.80$, $p < .001$ at team level), and characteristics of resilience and vulnerability under pressure ($r = -.46$, $p < .001$ at player level; $r = -.86$, $p < .001$ at team level).

Supplemental Table 1

Values of Fit Indexes of the Confirmatory Factor Analysis of the Variables included in the Study 1 and 2

Variable	χ^2	df	*p*	CFI	TLI	RMSEA	$SRMR_{playerlevel}$	$SRMR_{teamlevel}$
Study 1								
Time 1. Teamwork	522.811	124	<.001	.95	.94	.05	.03	.06
Time 1. Team resilience	1132.207	338	<.001	.93	.92	.04	.04	.23
Time 2. Teamwork	602.615	124	<.001	.94	.93	.06	.04	.05
Time 2. Team resilience	1121.562	338	<.001	.93	.92	.05	.04	.07
Study 2								
Time 1. Athlete leadership quality	13.604	4	<.001	.98	.95	.04	.02	.05
Time 2. Teamwork	602.615	124	<.001	.94	.93	.06	.04	.05
Time 2. Team resilience	1121.562	338	<.001	.93	.92	.05	.04	.07
Time 3. Perceived team performance	-	-	-	-	-	-	-	-

Supplemental Table 2

Values of Fornell-Larcker Criterion Heterotrait-Monotrait Ratio (HTMT) between Teamwork Execution and Characteristics of Resilience

Variables	1	2	3	4
Study 1				
1. Teamwork execution at Time 1	-			
2. Characteristics of resilience at Time 1	.81	-		
3. Teamwork execution at Time 2	-	.45	-	
4. Characteristics of resilience at Time 2	.31	-	.85	-
Study 2				
1. Teamwork execution at Time 2	-			
2. Characteristics of resilience at Time 2	.85	-		

Supplemental Table 3

MSEM of the Relationship between each Role of Perceived Athlete Leadership Quality (at Time 1), Teamwork (at Time 2), Team Resilience (at Time 2), and Perceived Team Performance (at Time 3) in Study 2

Time 1		Time 2		Time 3	*β*	*p*	95 % CI
Player level							
Quality of task leaders	→	Teamwork		-	.21	<.001	[.11, .32]
//	→	CR		-	.22	<.001	[.09, .34]
//	→	VU		-	-.13	.01	[-.20, -.05]
-		Teamwork	→	PTP	.22	<.001	[.08, .36]
-		CR	→	//	-.01	.83	[-.18, .02]
-		VU	→	//	-.08	.11	[-.15, .12]
Quality of social leaders	→	Teamwork		-	.26	<.001	[.18, .33]
//	→	CR		-	.28	<.001	[.18, .30]
//	→	VU		-	-.16	<.001	[-.24, -.08]
-		Teamwork	→	PTP	.20	.005	[.06, .35]
-		CR	→	//	.01	.93	[-.12, .14]
-		VU	→	//	-.07	.144	[-.17, .02]
Quality of external leaders	→	Teamwork		-	.20	<.001	[.11, .29]
//	→	CR		-	.23	<.001	[.15, .32]
//	→	VU		-	-.14	.001	[-.22, -.05]
-		Teamwork	→	PTP	.22	.003	[.07, .36]
-		CR	→	//	-.02	.81	[-.15, .12]
-		VU	→	//	-.08	.11	[-.18, .02]
Quality of motivational leaders	→	Teamwork		-	.16	.001	[.07, .29]
//	→	CR		-	.20	<.001	[.09, .31]
//	→	VU		-	-.18	.001	[-.25, -.07]
-		Teamwork	→	PTP	.22	.002	[.08, .36]
-		CR	→	//	-.02	.79	[-.15, .12]
-		VU	→	//	-.08	.10	[-.18, .02]

Team level							
Quality of task leaders	→	Teamwork		-	.30	.08	[-.04, .63]
//	→	CR		-	.29	.06	[-.01, .58]
//	→	VU		-	-.14	.29	[-.46, .18]
-		Teamwork	→	PTP	.29	.55	[-.68, 1.26]
-		CR	→	//	.09	.89	[-1.16, 1.16]
-		VU	→	//	-.14	.39	[-.46, .18]
Quality of social leaders	→	Teamwork		-	.49	.001	[.20, .78]
//	→	CR		-	.40	.001	[.11, .70]
//	→	VU		-	-.39	.02	[-.72, -.07]
-		Teamwork	→	PTP	.33	.49	[-.60, 1.26]
-		CR	→	//	.03	.96	[-1.20, 1.26]
-		VU	→	//	-.13	.71	[-.82, .56]
Quality of external leaders	→	Teamwork		-	.29	.06	[-.01, .68]
//	→	CR		-	.27	.14	[-.07, .67]
//	→	VU		-	-.22	.35	[-.49, .17]
-		Teamwork	→	PTP	.79	.56	[-.65, 1.22]
-		CR	→	//	.29	.86	[-1.10, 1.32]
-		VU	→	//	-.17	.78	[-.78, .58]
Quality of motivational leaders	→	Teamwork		-	.48	.005	[.15, .81]
//	→	CR		-	.36	.02	[.05, .68]
//	→	VU		-	-.32	.04	[-.63, -.08]
-		Teamwork	→	PTP	.22	.64	[-.72, 1.16]
-		CR	→	//	.17	.81	[-1.06, 1.41]
-		VU	→	//	-.08	.78	[-.78, .61]

Note. All coefficients presented are standardized; MSEM = Multilevel structural equation model; CR = Characteristics of resilience; VU = Vulnerability under pressure; PTP = Perceived team performance.

Supplemental Table 4

Standardized Parameter Estimates of Indirect Effects of each Role of Perceived Athlete Leadership Quality (at Time 1) on Perceived Team Performance (at Time 3), via Teamwork and Team Resilience (both at Time 2) in the Study 2

Input *Time 1*		Mediators *Time 2*		Outcome *Time 3*	*β*	*p*	95 % CI
From input (*Time 1*) to mediator (*Time 2*) to outcome (*Time 3*)							
Player level							
Quality of task leaders	→	Teamwork	→	PTP	.04	.02	[.01, .08]
//	→	CR	→	//	-.00	.83	[-.03, .02]
//	→	VU	→	//	.01	.16	[-.00, .02]
Quality of social leaders	→	Teamwork	→	//	.04	.009	[.01, .08]
//	→	CR	→	//	.00	.93	[-.03, .03]
//	→	VU	→	//	.01	.16	[-.00, .02]
Quality of external leaders	→	Teamwork	→	//	.03	.01	[.01, .05]
//	→	CR	→	//	-.00	.80	[-.02, .02]
//	→	VU	→	//	.01	.15	[-.00, .02]
Quality of motivational leaders	→	Teamwork	→	//	.03	.04	[.00, .06]
//	→	CR	→	//	-.00	.79	[-.02, .02]
//	→	VU	→	//	.01	.14	[-.00, .02]
Team level							
Quality of task leaders	→	Teamwork	→	PTP	.27	.55	[-.63, 1.17]
//	→	CR	→	//	.08	.89	[-1.03, 1.17]
//	→	VU	→	//	.04	.76	[-.25, .34]
Quality of social leaders	→	Teamwork	→	//	.53	.48	[-.95, 2.00]
//	→	CR	→	//	.04	.96	[-1.58, 1.67]

//	→	VU	→	//	.17	.70	[-.70, 1.03]
Quality of external leaders	→	Teamwork	→	//	.23	.54	[-.51, .96]
//	→	CR	→	//	.08	.87	[-.84, .99]
//	→	VU	→	//	.04	.77	[-.22, .29]
Quality of motivational leaders	→	Teamwork	→	//	.30	.64	[-.93, 1.52]
//	→	CR	→	//	.18	.79	[-1.10, 1.45]
//	→	VU	→	//	.08	.81	[-.54, .69]

Note. All coefficients presented are standardized; MSEM = Multilevel structural equation model; CR = Characteristics of resilience; VU = Vulnerability under pressure; PTP = Perceived team performance.