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Assessing the Relationship Between Pre- and Post-Game Interpersonal Emotions in Women's Football Teams

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Abstract

Researchers have identified that sport emotions are interpersonal and can be transferred between a team and its members. However, studies examining the transfer of emotions across different phases of competition are limited. Consequently, the present study examined the cross-sectional, autoregressive (stability), and cross-lagged (bidirectional) relationships between collective and group-based emotions over three consecutive football matches, whilst controlling for the performance outcome. Competitive female football players (N = 47, M_{age} = 20.06 years; SD = 1.67) completed a sport emotion questionnaire before and immediately after a match for three consecutive games. Players also completed a perfectionism towards teammates questionnaire one week prior to data collection at football matches. Bayesian dynamic structural equation modeling revealed that collective emotions were associated with group-based emotions pre-game, but this was the case only for positive emotions. In addition, perfectionism towards one's teammates was associated with group-based emotions at pre-game assessment. Emotions experienced at pre-game assessment were relatively stable at post-game assessment. Finally, collective emotions at pre-game assessment predicted group-based emotions at post-game assessment. It would appear that while the performance outcome strongly shapes players' group-based emotions following football matches, pre-game collective emotions may offer earlier indications of the likely intensity of an individual's group-based emotional response post-game; particularly when those emotions are negative.

Keywords: Bayes; collective emotions; ecological momentary assessment; group-based emotions; perfectionism

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Emotions in sport are inherently interpersonal (Tamminen et al., 2016). This is because emotions are a consequence of interactions with various stakeholders (e.g., teammates, coaches, parents, opposition) and, both an individual and collective response to sporting events (Campo et al., 2019; Tamminen et al., 2024). Emotions that are formed through any process of emotional exchange between individuals belonging to a group have broadly been described as emotional dynamics (Smith & Mackie, 2016), or interpersonal emotions. Interest in interpersonal emotions has increased in recent times, with sport researchers examining three distinct but interrelated interpersonal experiences: (a) how an individual's emotions are experienced in response to sporting events that have relevance for a team in which one identifies (i.e., group-based emotions; e.g., Rumbold et al., 2022), (b) how teams converge on the same emotional responses to sporting events (i.e., collective emotions; e.g., Freemantle et al., 2022), and (c) the processes by which individuals recognise and mimic the emotional expressions of others in teams (i.e., emotional contagion susceptibility; e.g., Cotterill et al., 2020). Examining interpersonal emotions within sport dyads, teams, and organisations is an important applied research endeavour, given the range of functions they serve. For example, the social sharing of positive emotions in groups can strengthen empathic understanding, team integration, and team goals to enhance performance (Rimé, 2009). Moreover, the social sharing of negative emotions can facilitate sense making and attempts at emotional recovery for the sharer, through venting or social validation (Ma et al., 2024). Shared positive and negative emotions can also provide an opportunity to reinforce groups' identities (Goldenberg et al., 2020), regulate intergroup conflict (Halperin, 2014) and strengthen group bonds (Wagstaff & Tamminen, 2021).

Despite a range of studies that have examined how different interpersonal emotion

experiences may operate in sporting dyads (e.g., Freemantle et al., 2022; Fritsch et al., 2024; Stebbings et al., 2016) and teams (Cotterill et al., 2020; Van Kleef et al., 2019; Wergin et al., 2024), most studies have examined these interrelated interpersonal experiences (i.e., group-based emotions, collective emotions, emotional contagion) separately from one another, rather than examining how they may influence and be affected by each other in varying competition environments (Rumbold et al., 2022). In addition, given that emotions are momentary responses to social interactions and events, it is surprising that there are limited studies that have examined the relationships between interpersonal emotion experiences temporally between competition phases (e.g., see Freemantle et al., 2022; Totterdell, 2000; Van Kleef et al., 2019). In the present study, we investigate how two interpersonal emotion experiences (i.e., collective emotions and group-based emotions) interrelate during two different phases of competition (pre- and post-competition).

Group-Based and Collective Emotions

Group-based emotions are individual-level emotions that occur in response to events, that have perceived relevance for an individual's social group in which they identify as being a member (Goldenberg et al., 2016). In this way, group-based emotions in sport are different to individual emotions insofar that a person appraises events encountered based on their social identity with a group (Campo et al., 2019). An example of individual emotions may include a football player experiencing negative emotions (e.g., dejection) when he/she misses a penalty. In contrast, group-based emotions may include a football player experiencing dejection regarding the team, when the team have lost a penalty shootout.

Collective emotions represent macro-level group-based emotions that emerge from interactions among group members who are feeling and responding to the same situation in the same way, and at the same time (e.g., a football team experiencing dejection in relation to their team after losing a penalty shootout; Goldenberg et al., 2020). As such, collective

emotions are different to group-based emotions. Group-based emotions reflect an individual's emotional response in relation to their team following an event. In comparison, collective emotions reflect a social group's emotional response in relation to their team following an event (Goldenberg et al., 2014, 2020). In one of the first studies to illustrate collective emotions in sport, Totterdell (2000) found that happy moods of individual cricket players were linked to the team's average level of happiness during competition. More recently, Freemantle et al. (2022) found that in table tennis dyads, collective within-dyad happiness, dejection and anger were evident immediately following a match. In a recent scoping review on convergence of emotions in sport, it was concluded that convergence of positive emotions is generally facilitative for performance, whilst convergence of negative emotions during sporting events could be a maladaptive factor leading to team collapse (Fritsch et al., 2024). Although collective emotions have been conceptualised by some researchers as a convergence of individual emotions in response to an event (irrespective of individuals' identity to their group; von Scheve & Ismer, 2013), we conceptualise collective emotions as representing group-based emotions that are shared and felt concurrently by various members of a group that people identify with (Goldenberg et al., 2014, 2020).

From a theoretical perspective, social psychology researchers have provided explanations for how collective and group-based emotions may converge, based on conscious (e.g., social identity, cognitive appraisal) and unconscious processes (mimicry, afferent feedback) (Hatfield et al., 1994; Lazarus, 1991; Tajfel, 1982). The Emotions as Social Information (EASI; Van Kleef, 2009) model blends these theoretical perspectives by suggesting that collective emotional expressions regarding events provide relevant information to group members, which may influence an individual's behaviour through inferential processes (e.g., inferring and appraising emotional displays) and affective reactions (mimicry, interpersonal liking). In addition, the strength with which inferential

processes and/or affective reactions may influence group-based emotions may depend on information processing (e.g., the person's motivation and ability to process the information from emotional expressions) or social-relational factors (e.g., the nature of group relationships, emotional display rules of a group) (Van Kleef, 2009).

In demonstrating the relationship between collective and group-based emotions in sport teams, Rumbold et al. (2022) found that for positive (e.g., excitement and happiness) and negative emotions (e.g., anxiety, dejection and anger), collective emotions were strongly associated with group-based emotions immediately following matches in male football teams, irrespective of game outcome. In addition, the convergence between collective and group-based emotions post-game was more pronounced for negative emotions (e.g., dejection and anger) than positive emotions (e.g., excitement, happiness). However, the relationship between collective and group-based emotions was only assessed at post-game. Therefore, research is needed to assess whether these significant relationships occur during other temporal phases of competition when emotions may be particularly heightened (e.g., pre-game; Wolf et al., 2018), as this could have important implications for team performance (Wergin et al., 2024), and future experiences of potentially unhelpful interpersonal emotions. Moreover, controlling for performance outcome when assessing emotion convergence is paramount to ensure that the relationship between individuals' emotional responses is not simply due to individuals responding similarly to the same critical event (Fritsch et al., 2024; Totterdell, 2000). In addition, recent research points to the performance outcome (especially when negative) being a trigger for worsening unhelpful emotional responses, which can be transferred between team members (Wergin et al., 2024).

Hypothesis 1. Collective emotions will be associated with group-based emotions at pre- and post-game competition phases.

In recent times, researchers have sought to determine whether achievement striving

dispositions may predispose teams to experience positive or negative emotions during phases of competition. Indeed, emotional responses are believed to be the result of how individuals appraise events in relation to their future achievement of goals (Lazarus, 1991). In addition, according to Mackie et al. (2000), group-based emotions are influenced by a person's level of identification with a social group and appraisals of events. Moreover, appraisals of events can be determined by personality dispositions in addition to the type of event experienced (Ruiz et al., 2023). One achievement striving personality disposition that is relevant to influencing sport emotions is perfectionism. Perfectionism has been described as a combination of excessively high standards and a preoccupation with critical evaluations (Hewitt & Flett, 1991). In a series of studies in youth football teams, Donachie and colleagues (Donachie et al., 2018, 2019) have shown that perfectionism predicts players' pre-competition negative emotions (e.g., anxiety and anger). Although these studies have examined perfectionism and emotions in the absence of perceived relevance for an individual's team, we believe that assessing perfectionism in the context of one's teammates may provide some indication of an individual's group-based emotions at different phases of a competition. Although our hypotheses are largely exploratory in this regard given the limited number of studies that have assessed perfectionistic thoughts towards teammates (see Hill et al., 214), we contend that perfectionistic pressure on teammates could be associated with greater positive group-based emotions. Given the co-dependent nature of team sports, and the requirement for shared expectations and aspirations, perfectionistic pressure on teammates may represent goal strivings and subsequently positive feelings (e.g., happiness, excitement) about a team in which an individual identifies. On the other hand, it is likely that negative reactions to nonperfect performance of teammates could produce greater negative emotions (e.g., anger, anxiety, dejection) about a team in which an individual identifies with. This is because individuals with high perfectionistic concerns have a higher tendency towards being critical

and holding a sense of doubt over performances (Ruiz et al., 2023). This would coincide with a large body work suggesting that highly critical negative reactions are largely maladaptive for sport experiences (Hill et al., 2018).

Hypothesis 2. Individual's perfectionism towards teammates will be associated with group-based emotions.

It is generally accepted in psychology literature that emotions often involve short-term responses to social exchanges and events that later fade away, or decline in intensity (Goldenberg et al., 2016). However, in the context of collective and group-based emotions in competitive sport environments, we believe that it might be possible for these interpersonal emotions to remain relatively stable across phases of a competition (irrespective of game outcome). This is because the EASI model (Van Kleef, 2009) posits that collective emotional expressions provide social information which may influence future feelings and behaviours. Future interpersonal group-based feelings may also be affected by individuals' understanding of emotional display rules within a team. Furthermore, although social group identification is an explanation for the generation of group-based emotions, it has also been argued that identification emerges as a by-product of collective emotions, which can then elicit new collective emotions that help groups organise (Goldenberg et al., 2020). Limited research has examined the transient nature of positive and negative collective (Freemantle et al., 2022) and group-based emotions throughout different phases of competition. Research is therefore warranted that assesses these variables in a time-lagged design, to evaluate whether interpersonal emotions occur temporally.

Hypothesis 3. Collective and group-based emotions will show time-lagged (i.e., autoregressive) relationships between pre- and post-game competition phases.

Studies examining emotional dynamic experiences in sport have typically explored the transfer of emotions as a unidirectional process from one interpersonal phenomenon (e.g.,

individual emotions) to another (e.g., collective emotions) (Fritsch et al., 2024; Moll et al., 2010; Totterdell, 2000; Van Kleef et al., 2019). For instance, in a multi field study conducted by Van Kleef et al. (2019), coaches' happiness and anger predicted team sport performers' happiness and anger before and during competition. However, there is likely to be degree of mutual influence between interpersonal emotion experiences, such that previous positive and negative collective emotions in response to events may elicit changes to an individual's group-based emotions in the future, and vice-versa. This is because individuals in relationships react to each other's actions and expressions and modify their interpersonal behaviours in response (Pinus et al., 2025). As such, it is imperative that researchers consider interpersonal emotion experiences in a bidirectional manner.

Hypothesis 4. Collective and group-based emotions will show bidirectional (i.e., cross-lagged) relationships with one another between pre- and post-game competition phases.

In the current study, we make an original contribution to the interpersonal emotions in sport literature in several ways. Firstly, using an experience sampling method (ESM; Hektner et al., 2007) we investigate how positive and negative group-based and collective emotions interrelate at pre- and post-game competition phases. Secondly, we examine how individual variability in positive and negative group-based emotions at different phases of competition may be influenced by perfectionism dispositions regarding teammates. Thirdly, we examine how the interrelationship between group-based and collective emotions may occur through autoregressive and cross-lagged explanations. Finally, given that quantitative studies on interpersonal emotions in sport to date have primarily researched male teams in isolation (e.g., Freemantle et al., 2022; Moll et al., 2010; Rumbold et al., 2022; Totterdell, 2000), or reported findings based on a small representation of females (e.g., Cotterill et al., 2020; Van Kleef et al., 2019), we believe that quantitative studies examining interpersonal emotions in female sport teams are lacking. Therefore, we examined the cross-sectional, autoregressive,

and cross-lagged relationships between positive and negative group-based and collective emotions in women's football teams over a series of competitive matches.

Materials and Methods

Participants and Procedure

The participants were 47 female football players (M_{age} = 20.06 years; *SD* = 1.67) who played competitively for English university teams (*n* = 3). On average, players had trained and competed for their university football teams for 1.55 years (*SD* = 1.66) and each team was involved in a structured national university league competition. Aside from competing for their university teams, 83% identified as playing for different teams across a range of levels within the English women's football pyramid. These included playing at club (55%), county (2%), regional (4%) and national level (13%), or playing for Tier 2 (Women's Championship, 4%) and Tier 3 (Women's National League, 4%) clubs. Seventeen percent of the 47 football players (*n* = 8) identified as holding a leadership role (e.g., captain or vice-captain) in their university football team. Of the participants who provided information pertaining to their indices of multiple deprivation (*n* = 43), 39.5% (*n* = 17) were raised by families living in the top 30% of the least deprived areas of England, whilst 18.6% (*n* = 8) of participants were raised by families living in the top 30% of the most deprived areas of England. Following institutional ethics approval [University Ethics ID: ER39488057], university football team coaches were approached by the second author who provided coaches with a participation information sheet, inviting their players to take part in the study. Female university players were then recruited via their respective coaches' request for volunteers. For each of the three participating football teams, the full team roster was represented by the participants. Each participant was provided with an information sheet which outlined the aim of the study. Anonymity and confidentiality were assured, and players were reminded of their right to withdraw from the study at any time.

Data were collected using paper questionnaires, which were distributed to participants by the second author. Players first completed a background questionnaire one week prior to a competitive game, providing demographic and sporting background information (e.g., age, competitive standard, length of time playing for their clubs). During this time, participants also completed a perfectionism questionnaire in relation to their teammates (cf., Stoeber et al., 2006). Following completion of these questionnaire, players completed a sport emotion questionnaire in their changing rooms 30 minutes prior to a competitive university league game, and immediately after the game. This process was repeated for three games in total, with one week separating each game. Regarding missing data, one player did not complete the pre- or post-game emotion questionnaire at the second game for their team. This approach was taken in line with ESM recommendations where event-contingent designs are employed (e.g., see Rumbold et al., 2020; 2022). The changing room was used as the location for collecting data on emotions, since measurement accuracy is enhanced and recall bias reduced when measuring emotions as close as possible to the events when emotions are stimulated (Hektner et al., 2007). In this context, the event or stimulus for triggering emotions was the team's preparation for a game (pre-game emotions) and the game outcome (post-game emotions). Secondly, as the purpose of the study was to assess how collective team emotions may affect individual group-based emotions before and after football games (and vice-versa), it was important for players to view and interpret the verbalised feelings and behaviours of teammates in their natural environment (i.e., the team's changing room facility) (cf. Csikszentmihalyi & Larson, 1987).

Measures

Group-based emotions. Participants' pre- and post-game emotions were assessed using the 22-item Sport Emotion Questionnaire (SEQ, Jones et al., 2005). To measure positive and negative group-based emotions before and after competitive games, players were

asked to indicate how they feel right now in relation to their team. The five subscales were anxiety (5 items, pre α = .81; post α = .89), dejection (5 items, pre α = .79; post α = .94), anger (4 items, pre α = .70; post α = .94), excitement (4 items, pre α = .78; post α = .86) and happiness (4 items, pre α = .83; post α = .94). Previous research has demonstrated reliability and validity for the SEQ (e.g., Arnold & Fletcher, 2015; Jones et al., 2005; Levillain et al., 2025). Each participant's mean score for excitement and happiness was aggregated into a mean score for positive group-based emotions. Similarly, mean scores for anxiety, dejection and anger were aggregated into a mean score for negative group-based emotions. To determine the amount of within and between team variance in positive and negative group-based emotions, we calculated the intraclass correlations (ICCs) at each game time point. At game time point 1, the ICCs were: pre-game negative group-based emotions = .01; post-game negative group-based emotions = .21; pre-game positive group-based emotions = 0.07; and post-game positive group-based emotions = .14. At game time point 2, the ICCs were: pre-game negative group-based emotions = .00; post-game negative group-based emotions = .37; pre-game positive group-based emotions = 0.01; and post-game positive group-based emotions = .22. At game time point 3, the ICCs were: pre-game negative group-based emotions = .02; post-game negative group-based emotions = .79; pre-game positive group-based emotions = 0.07; and post-game positive group-based emotions = .65. Small ICC values closer to zero suggest that within-team variance is much greater than between-team variance, whereas larger ICCs provide empirical support for aggregation of within-person data (group-based emotions) at the team level (collective group-based emotions) (Kenny & La Voie, 1985).

Collective group-based emotions.[1] To compare each player's group-based emotion scores to their team's collective emotion scores at each measurement timepoint, a team aggregated mean score (excluding the individual player mean score this was being compared

to) was calculated for each of the three participating teams. This enabled the assessment of emotion linkage between a player's group-based emotions and their team's collective emotions about the team (Goldenberg et al., 2020) before and after three separate games.

Covariates. A selection of dispositional and situational variables were included as time variant and invariant covariates. According to theories of emotion (Lazarus, 1991), individual variability in emotional responses may be due to changes over time and can typically be the result of interpreting and responding to an event. Therefore, the game outcome (e.g., 0 = 'no win', 1 = 'win') was dummy coded as a time variant covariate for each of the three competitive games. Each of the three teams sampled had experienced a win and a loss across the three competitive matches.[2] Perfectionism was included as a time invariant covariate, as the requirement for individuals to be perfect has been consistently linked to explaining variability in performance-related emotions in sport (Donachie et al., 2018, 2019; Ruiz et al., 2023). Given the team dynamic nature of the current study, perfectionism was measured using two teammate-related subscales of the Multidimensional Inventory of Perfectionism in Sport (MIPS; Stoeber et al., 2006). Perfectionistic pressure on teammates (PPT; 8 items; $\alpha = .95$) measures an individual's pressure on their teammates to be perfect (e.g., "It is important to me that my teammates do everything perfectly"), whilst negative reactions to nonperfect performance of teammates (NRNPT; 8 items; $\alpha = .95$) measures an individual's typical response when teammates do not meet their high expectations (e.g., "I get annoyed with my teammates if their performance is not first class"). Participants rated to what degree each statement characterised their perfectionistic attitudes towards their teammates on a scale from 1 (strongly disagree) to 5 (strongly agree). Previous research has demonstrated reliability for the PPT and NRNPT subscales (Stoeber et al., 2006).

Data Analysis

Bayesian dynamic structural equation modeling (DSEM) was utilised to examine the

cross-sectional, autoregressive, and cross-lagged relationships between group-based and collective emotions across three competitive games. Bayesian DSEM is an appropriate method to examine dynamic relationships between variables in small sample groups over time (McNeish & Hamaker, 2020; Nelson et al., 2011). For readers interested in a deeper understanding of Bayesian statistics, we refer readers to Zyphur and Oswald (2015) and Chen et al. (2024) who introduce the foundations of Bayesian estimation and inference, and Myers et al. (2018) and van de Schoot et al. (2014) who provide a helpful table outlining the key differences between traditional frequentist and Bayesian principles. The main underlying difference between Bayesian inference and frequentist approaches is how the probability of something occurring is viewed and estimated. Bayesian inference interprets probability as a subjective experience of uncertainty (akin to placing a bet on an event occuring), in comparison to frequentist paradigms which employ infinitely repeating sampling of an event (Slater, 2022). Secondly, in a frequentist paradigm, it is assumed that in the participant population of interest there is only one true parameter (i.e., one true regression coefficient) for a specific statistical relationship. With Bayesian analysis, all parameters are considered as uncertain and subsequently should be interpretated by way of a probability distribution for each parameter (Chen et al., 2024).

All analyses were conducted using M*plus* 7.0. First, we estimated a cross-sectional model for group-based and collective emotions and an autoregressive model for the pre- and post-game data. Separate models were estimated for positive and negative emotions. Secondly, we added cross-lagged effects to assess whether pre-game group-based emotions would predict post-game collective emotions, and whether pre-game collective emotions would predict post-game group-based emotions. We then included time variant and invariant covariates to the cross-lagged models. The game outcome for each of the three competitive games was entered as a time variant covariate for post-game group-based emotions, and

perfectionism (PPT and NRNPT) was grand-mean centered as a time invariant covariate for both pre- and post-game group-based emotions.

For both the autoregressive and cross-lagged models, we used Markov Chain Monte Carlo simulation procedures with a Gibbs sampler and estimated the models with 50,000 iterations. Due to the difficulty of drawing on adequate informative priors from previous research, we used the default uninformative prior distribution in M*plus*. Uninformative priors mimic frequentist maximum likelihood (ML) by estimating a likelihood for parameter estimates based solely on the data collected (Ulitzsch et al., 2023). However, Bayesian analysis differs to ML such that ML produces a single point estimate for each parameter, whereas Bayesian produces a whole distribution of possible values for each parameter. This distribution is known as the posterior probability distribution (McNeish & Hamaker, 2020). In addition, Bayesian estimation produces posterior (probability) distributions for each parameter estimate, and these posterior distributions form the subjective basis of a researcher's probability statement regarding the likelihood that a parameter estimate value is likely given the dataset (Slater, 2022).

Posterior predictive *p* (PP*p*) and the 95% confidence interval were employed to assess model fit. A low PP*p* value (e.g., < .05) closer to zero and a positive lower limit for the 95% credibility interval indicates a poor model fit (Winter & Depaoli, 2023). In contrast, although there are no clear "cut-off" criteria for assessing adequate or good values, it is generally accepted that PP*p* values around .50 indicate a well-fitting model (Chen et al., 2024; van de Schoot et al., 2014; Zyphur & Oswald, 2015). When comparing the autoregressive and cross-lagged models we observed the deviance information criterion (DIC) in which smaller DIC values indicate better fitting models. In addition, a potential scale reduction (PSR) factor of approximately 1 was considered as evidence of model convergence (Zyphur & Oswald, 2015). For all parameter estimates, we observed the 95%

credibility interval ranges. In line with Zyphur and Oswald's (2015) recommendations, we rejected the null hypothesis if a moderate (e.g., > 70%) or large (e.g., > 90%) percentage of each parameter's posterior distribution did not include zero.

Results

Table 1 shows the means, standard deviations, reliabilities and correlations for group-based and collective emotions at pre- and post-game assessments, and covariates.

Positive Emotions

Figure 1 illustrates the cross-sectional, autoregressive, and cross-lagged relationships between positive group-based and collective emotions across three competitive games. Table 2 illustrates that the cross-lagged model with covariates represented an adequate fit to the data (PPp = 0.31, 95% Confidence Interval [-22.29, 19.51], DIC = 1282.15).[3] From this model, the results provided strong evidence (probability = 0.996) that positive group-based emotions were associated with positive collective emotions pre-game (β = 0.31). In addition, there was strong evidence (probability = 0.898) that perfectionistic pressure on teammates (PPT) was positively associated with positive group-based emotions pre-game (β = 0.27). Conversely, negative reactions to nonperfect performances of teammates (NRNPT) was inversely associated with positive group-based emotions pre-game (β = -0.20). The probability that the 95% credible interval fell outside of zero was moderate at 78.4% (see Table 3).

When assessing the relationship between pre- and post-game positive group-based emotions, there was strong evidence (probability = 0.969) of a positive association (β = 0.23). This finding indicates that positive group-based emotions were credible and stable between pre- and post-game assessments (see Figure 1). Moderate evidence (probability = 0.803) was found for a cross-lagged effect, such that positive collective emotions at pre-game inversely predicted positive group-based emotions post-game (β = -0.15) (see Table 3). Finally, there

was strong evidence (probability = 0.976-1.000) that wins were associated with positive group-based (β = 0.40) and collective emotions (β = 0.88) post-game.

We also explored the relationships between distinct positive interpersonal emotions (i.e., happiness and excitement) in separate models. For happiness, a poorer model fit was identified (PP*p* = 0.24, 95% Confidence Interval [-13.56, 28.60], DIC = 1368.66) in comparison to the aggregated positive emotions model, and the findings were similar. For excitement, an improved model fit was identified (PP*p* = 0.37, 95% Confidence Interval [-17.74, 24.21], DIC = 1269.11). In addition, a stronger association was found between group-based and collective emotions at pre-game assessment (β = 0.40), in comparison to the aggregated positive emotions model (β = 0.31).

Negative Emotions

Figure 2 illustrates the cross-sectional, autoregressive, and cross-lagged relationships between negative group-based and collective emotions across three competitive games. Table 2 shows that the cross-lagged model with covariates indicated a good fit to the data (PP*p* = 0.56, 95% Confidence Interval [-15.88, 26.78], DIC = 790.23). From this model, there was weak evidence of a relationship between negative group-based and collective emotions at pre- (β = 0.09) or post-game (β = 0.01) assessments (probability = 0.492-0.663). On the other hand, there was strong evidence (probability = 0.975) that NRNPT was associated with negative group-based emotions pre-game (β = 0.36).

There was strong evidence (probability = 1.000) to suggest that both negative group-based (β = 0.48) and collective emotions (β = 0.60) were stable between pre- and post-game assessments. In addition, strong evidence (probability = 0.918) was found for a positive cross-lagged effect, such that negative collective emotions at pre-game predicted negative group-based emotions post-game (β = 0.29). On the other hand, when assessing the reverse cross-lagged effect, there was moderate evidence (probability = 0.712) that negative group-

based emotions at pre-game predicted negative collective emotions post-game (β = 0.11) (see Table 3). Finally, there was strong evidence (probability = 0.991-1.000) that less wins were associated with higher negative group-based (β = -0.52) and negative collective emotions (β = -0.77) at post-game assessment.

We also explored the relationships between distinct negative interpersonal emotions (i.e., anxiety, anger and dejection) in separate models. Model fit was not improved for any of the specific emotion models. However, dejection demonstrated an adequate model fit (PP*p* = 0.37, 95% Confidence Interval [-17.90, 24.64], DIC = 1228.15), and some findings were markedly different to the aggregated negative emotions model. Firstly, there was strong evidence (probability = 1.000) to suggest that group-based dejection was associated with collective dejection at post-game (β = 0.59), in comparison to the negative emotions model which showed no relationship (β = 0.01). Secondly, the cross lagged effect whereby negative collective emotions at pre-game predicted negative group-based emotions at post-game (β = 0.29) became non-probable when assessing the same cross-lagged effect for dejection only (β = -0.04). Finally, when assessing dejection in isolation, we found that there was no evidence of a statistical relationship between less wins and group-based dejection at post-game assessment (β = -0.08), in comparison to the aggregated negative emotions model (β = -0.52).

Discussion

This study examined the relationships between group-based and collective emotions in women's football teams. Using an Experience Sampling Method (ESM) to provide ecologically valid information at pre- and post-match assessments, we found partial support for Hypothesis 1, such that group-based emotions were associated with collective emotions pre-game, but only for positive emotions. These findings are supported by social functional theories of emotion (Van Kleef, 2009) which suggest that collective experiences regarding events provide social information to group members that can lead to convergence of emotions

about one's group. It was surprising that the evidence linking group-based and collective emotions at post-game assessment was weak, which contrasts previous findings with male football teams (Rumbold et al., 2022).

One explanation might be the nature of events that are being appraised at pre- and post-game assessments. In preparation for a game, players and teammates may be appraising and responding to how they feel in anticipation of competing. As such, the social exchanges and individual evaluations that occur in this context could lead to stronger convergence of collective and group-based emotions (Goldenberg et al., 2020). In comparison, at post-game assessment, there could be greater variability between team members in their group-based emotions due to the game outcome (Fritsch et al., 2024). Players may appraise the importance of the game outcome differently depending on whether the game outcome could harm the achievement of individual and team goals, or harm how an individual socially identifies within their team. Taken together, these findings highlight the importance of conducting assessments of group-based and collective emotions across different phases of competition, rather than assessing the convergence of emotions at single time points. Future studies could look to extend our ESM approach alongside a measurement of objective events encountered and group-based cognitive appraisals.

We found partial support for Hypothesis 2, in so far that perfectionism dispositions towards teammates was associated with pre-game emotions through PPT and NRNPT. Although both perfectionism and emotions are group-referenced (i.e., the team) in this study, the findings do provide support for previous research that has shown perfectionism to be strongly associated with pre-competition emotions in youth footballers (Donachie et al., 2018, 2019). This can be explained by theories of appraisal and emotion (Lazarus, 1991) in which emotional responses are largely influenced by the appraisals individuals make of events in relation to their goals, and personality dispositions can influence one's appraisals in

this regard (Mackie et al., 2000; Ruiz et al., 2023). In addition, given the requirement for shared expectations and aspirations in the lead up to a competition, perfectionistic pressure on teammates could represent thoughts about team goal strivings and subsequently positive feelings (e.g., happiness, excitement) about the team pre-competition. To our knowledge, there are a limited number of studies that have utilised teammate-related measures of perfectionism (e.g., see Hill et al., 2014). Therefore, this study offers some predictive validity of the PPT and NRNPT subscales of the MIPS (Stoeber et al., 2006). Given that our findings showed that NRNPT was showing signs of being related to post-game emotional responses, it is possible that perfectionism dispositions towards teammates and the game outcome may have explained greater variance in group-based emotions post-game than collective emotions. There are a couple of explanations for this. Firstly, perfectionism towards teammates represents a stable disposition regarding how a person views others. Therefore, players demonstrating a high degree of NRNPT are likely to hold these negative views for a sustained period and draw on this tendency to be critical of others when opportunities arise (following a win or loss). In comparison, collective emotions about the team are more malleable to change in response to the events (win or loss) that influence how the collective feels about the team in the moment. Negative reactions to the imperfection of teammates, especially in the context of imperfect performance (particularly losses), will likely have stronger implications for one's emotions, and certainly how one feels about others. There is a growing body of evidence that other-oriented forms of perfectionism (i.e., a need for others to be perfect rather than the self) are associated with angry reactions and antisocial behaviour towards teammates (Grugan et al., 2020). Furthermore, there is a large body of evidence showing that highly critical negative reactions to imperfection disrupt sport experiences (Hill et al., 2018). This might be an interesting association for researchers to consider examining in future assessments of sport teams' group-based emotions.

Limited research in sport has examined the episodic nature of group-based and collective emotions throughout different phases of competition. Applying a time-lagged approach this study makes an original contribution in supporting Hypothesis 3. Our study makes a unique contribution to the interpersonal emotions in sport literature by showing that, in three out of four autoregressive relationships examined, group-based and collective emotions at pre-game assessment predicted group-based and collective emotions at post-game assessments, irrespective of perfectionism dispositions towards teammates and game outcome. From a theoretical perspective (EASI: Van Kleef, 2009), this makes sense since group-based and collective emotions that are identified prior to competition may positively reinforce team identities (Mackie et al., 2000; Pinus et al., 2025) and future interpersonal feelings about one's team (e.g., reciprocal liking), based on information processing (e.g., the processing of emotional expressions) and social-relational factors (e.g., understood group emotional display rules).

To our knowledge, this is also the first study to examine collective and group-based emotions in a cross-lagged manner across phases of sport competition. We found some initial support for a cross-lagged relationship (hypothesis 4), insofar that negative collective emotions pre-game predicted negative group-based emotions post-game. In addition, negative group-based emotions pre-game showed some signs of credibly predicting negative collective emotions following matches. These initial findings begin to answer questions around the bi-directional relationship of interpersonal emotions (Tamminen et al., 2024), alongside the question of what causes collective emotions to occur in sport groups (Freemantle et al., 2022). Our cross-lagged findings illustrate that collective emotions can lead to later group-based emotions in competitive sport environments, but group-based emotions prior to a game may go some way to predicting the collective emotions of female football teams following matches. We recommend that researchers interested in examining emotional dynamics in

sport dyads and teams should explore these interpersonal phenomena together (i.e., rather than in isolation from one another), to test these potential bi-directional relationships further. Although our findings point to collective emotions being a stronger predictor of later group-based emotions (than vice-versa), the opposite could be just as apparent in contexts where leaders' (e.g., team captains, coaches) expressions of emotions towards a team influence the formation of stronger collective emotional responses (e.g., see Cotterill et al., 2020).

Limitations and Future Research

A strength of this study was the use of ESM to provide ecologically valid information on transient group-based and collective emotions throughout phases of sport competition. Whilst recognising the practical challenges, future research could attempt to follow the methodological recommendations of Wagstaff and Tamminen (2021) regarding the need for greater in-competition assessment when measuring sport emotions. We agree that this is an important future research endeavour, but only as part of a wider range of ESM assessments of interpersonal emotions across the training, competition, and sport team / organisational environment. Indeed, it would be interesting to examine other time lagged approaches, such as examining the influence of post-game interpersonal emotions on future interpersonal emotions at subsequent competitions. Linked to the latter, case study time series designs could be adopted to link episodic interpersonal emotions to future performance actions, to identify which emotions are helpful or unhelpful for future performance for an individual team. Regarding study limitations, we acknowledge that aggregating positive and negative emotions doesn't tell researchers about the fluctuations in specific collective and group-based emotions (e.g., happiness, anxiety), which is an approach researchers have employed when examining these interpersonal emotions (e.g., Freemantle et al., 2022; Rumbold et al., 2022). Our exploratory analysis of distinct emotions for group-based and collective emotions at pre- and post-game assessments does suggest that for some emotions (e.g., excitement, dejection),

the relationship between group-based and collective emotions could be more prominent. This is worthy of further exploration in future research in sport and non-sport settings (Metzler et al., 2023). In addition, from an applied perspective measuring fluctuations in the valence (i.e., pleasantness, unpleasantness) of interpersonal emotions is perhaps more useful for intervention development in teams (see Pinus et al., 2025) than understanding which specific emotions (e.g., happiness, anger, dejection) show convergence between individuals and their team. Another consideration for future research could be to capture episodic collective emotions differently, by examining the convergence of individuals' emotions following events (von Scheve & Ismer, 2013), rather than the aggregation of a team's group-based emotions.

Although the sample size (N = 47) and number of observations across three competitive matches (n = 6; df = 282) is not an issue for conducting complex Bayesian DSEM (in comparison to traditional SEM), the impact of prior probability distributions (e.g., informative, empirical, uninformative) on posterior distributions for parameter estimates can be important for smaller sample sizes and can diminish as sample sizes increase (Chen et al., 2024). We used uninformative priors due to limited prior knowledge regarding pre- and post-game interpersonal emotions in women's football teams. Uninformative priors mimic frequentist maximum likelihood estimation, such that the estimation of posterior probabilities for parameter estimates is dominated by the data only. Subsequently, the inclusion of prior knowledge (e.g., informative priors) could help to strengthen the posterior probability distributions (Winter & Depaoli, 2023). Extending our approach to a larger group of female football teams, combined with greater observations across competitive match phases or periods of the season may offer even greater insight into the cross-lagged effects of interpersonal emotions, particularly if the current study data was used as informative priors to strengthen the probabilistic interpretation of parameters.

Our findings do address Rumbold and colleagues' (2022) assertion regarding the generalisability of group-based and collective emotion relationships in male team sport populations. Specifically, we found that the relationship between group-based and collective emotions post-game is different in female teams to what has currently been reported in male teams (see Rumbold et al., 2022). From an applied perspective, this may suggest that there could be gender differences in how females and males appraise events in relation to their team immediately following games. Moreover, the findings could hint at differences in how females and males adhere to a different set of display rules for emotional expression in the same sport team context.

Conclusion

In conclusion, we examined the cross-sectional, autoregressive, and cross-lagged relationships between group-based and collective emotions in women's football teams over a series of competitive matches. The findings provide support for social functional theories of emotions in sport (Van Kleef, 2009) and further highlight that emotions in sport are a consequence of social exchanges in relation to commonly experienced events. From an applied perspective, our findings suggest in the women's game, footballers should be wary of the effect that collective displays of negative emotions can have for reinforcing their feelings about the team, which may affect collective behaviour and team performance (Fritsch et al., 2024; Wergin et al., 2024). Collecting information on group-based and collective emotions in a time series manner could serve as the basis for a series of team reflective and team re-appraisal exercises (e.g., see Pinus et al., 2025). Such reflective exercises could stimulate team consensus on expectations regarding emotional display rules at different phases of competition. They could also grow awareness for football players, their coaching and support staff of how interpersonal emotions at different match phases may have sustained influence for future interpersonal emotions, and potentially performance.

Disclosure statement

The authors report no conflict of interest.

Data availability statement

The data and materials supporting the findings of this study are openly available on the open science framework at https://doi.org/kkcd

Footnote

1. For brevity throughout the remainder of this paper, "collective group-based emotions" will heron be referred to as "collective emotions".
2. In our analysis, we explored controlling for team membership in our cross-lagged model, but this negatively affected the fit for the cross-lagged model, and there were no differences in the relationships assessed between the original, better fitting model.
3. Despite this model appearing to demonstrate a poorer fit than the cross-lagged model without covariates (PP*p* = 0.51, 95% Confidence Interval [-14.31, 13.94, DIC = 840.66), we decided to report the cross-lagged model with covariates due to the larger number of parameters in the model and due to the increase in r-squared for emotion variables. We interpret the change in PPp and DIC from model 2 (the cross lagged model without covariates) to model 3 (the cross-lagged model with covariates) for positive and negative emotions as a consequence of the additional 11 parameter estimates being estimated, and the change in r-squared for positive and negative emotions between models 2 and 3.

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Table 1. Means, standard deviations, internal consistencies, and correlations

	M	*SD*	α	1	2	3	4	5	6	7	8	9	10	11
1. Pre-game positive emotions	1.50	0.62	.88	—										
2. Pre-game collective positive emotions	1.50	0.28	-	.32	—									
3. Post-game positive emotions	1.32	0.96	.95	.18	-.04	—								
4. Post-game collective positive emotions	1.32	0.56	-	-.03	-.02	.50	—							
5. Pre-game negative emotions	0.65	0.39	.85	.31	.18	-.16	-.02	—						
6. Pre-game collective negative emotions	0.65	0.11	-	.29	.75	-.04	-.12	.05	—					
7. Post-game negative emotions	0.76	0.75	.95	.25	.39	-.57	-.49	.52	.30	—				
8. Post-game collective negative emotions	0.76	0.52	-	.25	.57	-.41	-.75	.12	.58	.64	—			
9. PPT	2.78	1.14	.95	.06	-.15	-.15	.04	.32	-.10	.11	-.09	—		
10. NRNPT	2.08	0.93	.95	-.05	-.21	-.17	.04	.38	-.12	.16	-.14	.81	—	
11. Win	0.56	0.50	-	-.01	.09	.44	.71	-.04	.12	-.51	-.65	.05	.08	—

Note. $N = 47$; N of observations = 140. Underlined values indicate significant correlations, $p < .05$. PPT = Perfectionistic pressure on teammates; NRNPT = Negative reactions to nonperfect performance of teammates.

Table 2. Model fit comparisons

Model	Parameters	PPp [95% CI]	DIC
Positive emotions			
Cross-sectional and autoregressive model	10	.51 [-14.60, 14.50]	838.66
Cross-lagged model	12	.51 [-14.31, 13.94]	840.66
Cross-lagged model with covariates	23	.31 [-22.29, 19.51]	1282.15
Negative emotions			
Cross-sectional and autoregressive model	10	.42 [-12.98, 14.73]	494.76
Cross-lagged model	12	.48 [-13.73, 15.24]	495.72
Cross-lagged model with covariates	23	.56 [-15.88, 26.78]	790.23

Note. PPp = Posterior predictive *p*; CI = 95% confidence intervals; DIC = Deviance information criteria

Table 3. Parameter estimates and posterior distributions for positive and negative emotions.

	Positive Emotions				Negative Emotions			
Parameter	2.5%	β	97.5%	$P > 0$	2.5%	β	97.5%	$P > 0$
Pre-game group-based emotions								
Intercept	-0.16	0.70	1.61	1.000	0.15	1.08	2.02	1.000
Pre-game collective emotions	0.16	0.31	0.45	0.996	-0.06	0.09	0.24	0.492
PPT	-0.01	0.27	0.53	0.898	-0.23	0.03	0.29	0.486
NRNPT	-0.46	-0.20	0.08	0.784	0.10	0.36	0.61	0.975
R^2	0.05	0.14	0.25	0.796	0.07	0.17	0.29	0.912
Post-game group-based emotions								
Intercept	-0.03	0.83	1.67	1.000	-1.77	-0.95	-0.08	0.983
Pre-game group-based emotions	0.09	0.23	0.37	0.969	0.36	0.48	0.59	1.000
Pre-game collective emotions	-0.28	-0.15	-0.01	0.803	0.01	0.29	0.56	0.918
Post-game collective emotions	-0.15	0.14	0.43	0.671	-0.42	0.01	0.44	0.663
Win	0.10	0.40	0.66	0.976	-0.86	-0.52	-0.17	0.991
PPT	-0.28	-0.06	0.17	0.469	-0.27	-0.10	0.07	0.549
NRNPT	-0.42	-0.19	0.04	0.796	-0.02	0.16	0.33	0.755
R^2	0.28	0.40	0.51	1.000	0.56	0.65	0.73	1.000
Post-game collective emotions								
Intercept	0.95	1.41	1.88	1.000	-1.63	-1.41	-1.18	1.000
Pre-game collective emotions	-0.08	0.00	0.08	0.022	0.57	0.60	0.63	1.000
Pre-game group-based emotions	-0.12	-0.03	0.05	0.068	0.07	0.11	0.15	0.712
Win	0.85	0.88	0.91	1.000	-0.80	-0.77	-0.75	1.000
R^2	0.73	0.79	0.83	1.000	0.93	0.95	0.96	1.000
PPT with NRNPT	0.74	0.81	0.86	1.000	0.74	0.81	0.86	1.000

Note. PPT = Perfectionistic pressure on teammates; NRNPT = Negative reactions to nonperfect performance of teammates; $P > 0$ = the posterior probability that the parameter estimate is greater than 0.

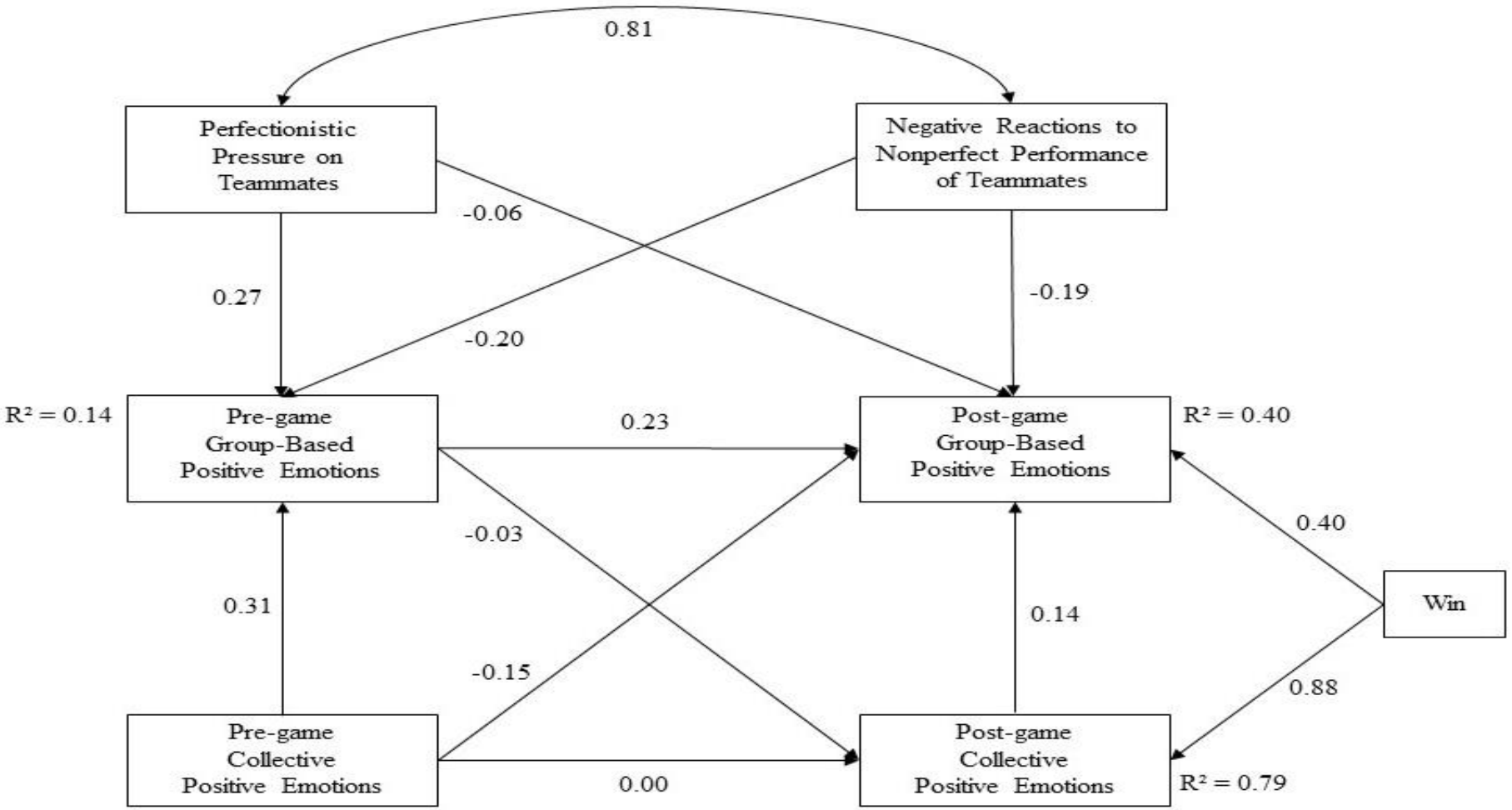

Figure 1. Cross-sectional, autoregressive and cross-lagged relationships between positively valanced pre- and post-game emotions. Standardized estimates are presented. PPp = 0.31, 95% Confidence Interval [-15.88, 26.78]

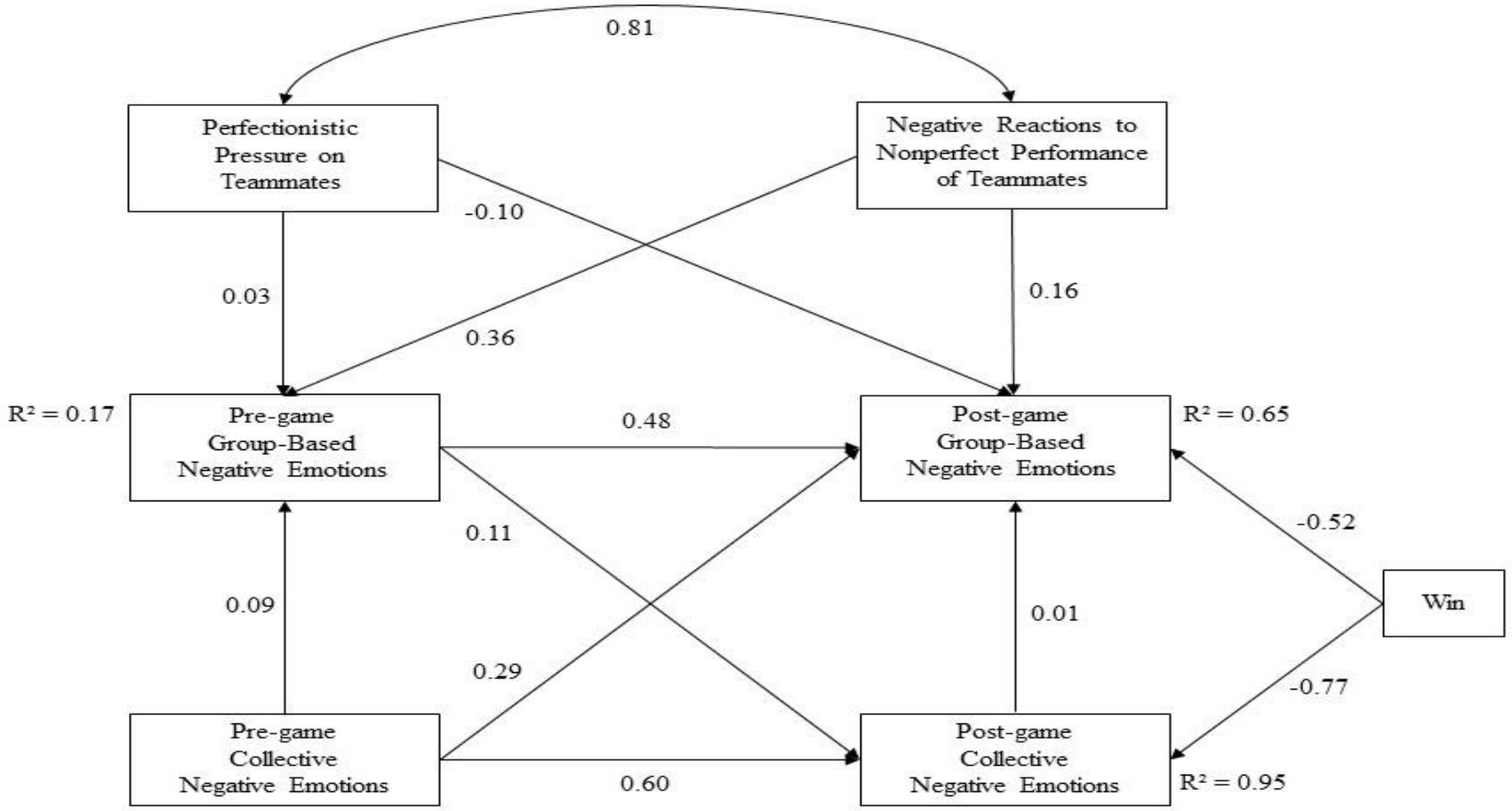

Figure 2. Cross-sectional, autoregressive and cross-lagged relationships between negatively valanced pre- and post-game emotions. Standardized estimates are presented. PPp = 0.56, 95% Confidence Interval [-22.29, 19.51]