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Network centrality, group density, and strength of social identification in college club sport teams

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Abstract

Objective: With the underlying rationale that social identification is related to psychological health and well-being, we aimed to understand how social connections and group structure within college club sport teams relate to students' perceptions of social identification.

Method: We sampled 852 student-athletes from 35 intact same-sex college club sport teams. Using social network analyses derived from teammates' reports of connections with one another (i.e., time spent outside of sport, and teammate friendships), we computed: outdegree centrality (i.e., self-reported connections with teammates), indegree centrality (i.e., nominations from others), and group-level density. Multilevel models were fit to test the relative effects of outdegree centrality, indegree centrality, and group-level team density on athletes' social identification strength.

Results: Outdegree centrality, indegree centrality, and team density were all positively related to the strength of athletes' social identification with their sport team. Examining model results step-by-step, incoming nominations of social connections (i.e., indegree) were associated with social identification beyond the effects of self-reported outdegree centrality. Furthermore, team-level density was significantly related to social identification after accounting for the individual-level effects of centrality.

Conclusion: Sport is a domain where participants can build social connections with peers, and sport groups offer a salient source for social identification. The current findings indicate that athletes who have greater social connections with teammates may form a stronger sense of social identification. Alongside theoretical contributions to a social identity approach to studying small groups, the current study highlights the utility of studying small groups using social network methodologies.

Keywords

Social Network Analysis; Social Identity; Multilevel Modeling; Sport Teams

The social groups to which we belong are salient sources of information pertaining to our sense of our place in the social world. Indeed, the knowledge of group memberships shapes individuals' social identities, which entail the aspects of the self-image that are derived from the social categories to which one perceives themselves as belonging to (Tajfel & Turner,

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1979). Identifying with a social group is a motivated process of self-categorization that focuses on maintaining positive views of one's group and is driven by several motives such as belongingness seeking, enhancing self-esteem, and finding meaning in one's life (Vignoles, Regalia, Manzi, Golledge, & Scabini, 2006).

Whereas social *identity* refers to the group as a perceived entity, social *identification* refers to individuals' relationship to that entity, including the strength with which one identifies (Postmes, Haslam, & Jans, 2013). Cameron (2004) introduced a multidimensional perspective of social identification strength that entails *ingroup ties* (i.e., perceptions of similarity, bonding, and belongingness with fellow members), *ingroup affect* (i.e., positive feelings about group membership), and *cognitive centrality* (i.e., importance of being a group member). This conceptualization of social identity has gained favor among sport and organizational psychology researchers as it is particularly relevant for studying how individuals identify with small groups (e.g., work teams), as opposed to larger sources of identity (e.g., nationality).

Small groups, in particular, are widespread and have a very salient impact on individuals' lives (Forsyth, 2019). There is growing recognition that identifying strongly with a group is associated with numerous psychological benefits including mental health and well-being (e.g., Jetten, Haslam, Haslam, Dingle, & Jones, 2014). Indeed, identifying strongly with a group can provide individuals with a sense of meaning, purpose, and belonging, which entail positive psychological consequences (Haslam, Jetten, Postmes, & Haslam, 2009). Additional evidence indicates that social identification has a positive impact on well-being because it satisfies global psychological needs including the need to belong, need for self-esteem, and need for meaningful existence (Greenaway, Cruwys, Haslam, & Jetten, 2016). Whereas individuals can receive these psychological benefits through identifying with many types of social groups, such as neighborhoods, family groups, or churches, there has been a growing interest in identities that form around memberships to sport and exercise groups (Bruner, Dunlop, & Beauchamp, 2014).

Sport and Exercise as a Context for Studying Small Group Identities

Sport groups provide a readily accessible and important context for studying small groups. Taking place predominately in social settings alongside others who constitute a group, exercisers and athletes often incorporate physical activity groups into their sense of self (Rees, Haslam, Coffee, & Lavallee, 2015). Identifying with these groups can influence behavioral outcomes, such as physical activity adherence and conformity to group norms (Evans, McLaren, Budziszewski, & Gilchrist, 2019; Graupensperger, Benson, & Evans, 2018). Specific to sport, there is evidence that when young athletes report strong identities within their teams, they are expected to report increased group cohesion (Bruner, Boardley, & Côté, 2014) and greater development of personal and social skills (Bruner et al., 2017), alongside feeling more committed to the team (Martin, Balderson, Hawkins, Wilson, & Bruner, 2017).

Given the many positive outcomes associated with group social identification, sport researchers have recently stressed the value in understanding its potential antecedents.

Researchers in this domain sought to identify associations between social identification and constructs that are theoretically positioned as antecedents, though the use of correlational designs have limited researchers' ability to make causal inferences. For instance, research with sport teams has found that perceptions of outcome interdependence, groupness, and being a formal or informal team leader were all significantly related to social identification (Bruner, Eys, Evans, & Wilson, 2015; Martin et al., 2017). Researchers have also found that daily responses regarding social identification strength may fluctuate as a response to teammates' moral behaviors: Athletes' social identification was stronger on days when participants experienced more prosocial behaviors from teammates, and was weaker after experiencing more antisocial behaviors (Benson & Bruner, 2018). However, Benson and Bruner note that the association may be reciprocal. Nevertheless, these findings align with group researchers outside of sport who posit that social identification emerges through inductive and deductive processes prompted by member interactions (Jans, Postmes, & Van der Zee, 2011; Postmes, Spears, Lee, & Novak, 2005). This theoretical perspective holds that social identification strength is determined both by bottom-up processes, such as one's social position in their group (i.e., inductive), and by top-down processes relating to the group as a whole, such as how tightknit the members are (i.e., deductive). Social identity theorists specifically contend that a group's structure, particularly in terms of intragroup relations among members, plays a key role in the extent that individuals identify with the group (Hogg, 1996). Thus, there is theoretical and empirical support for expectations that the properties of small groups are potential antecedents that predict the strength to which members identify.

Despite evidence that the social environment in sport teams may play a central role in the construction of an athlete's social identity, we know little about how variability in social identities may be related to a team's social structure and the nature of members' social interactions with one another. Sport is widely considered to be an ideal domain for the development of close interpersonal relationships and social connectedness among peers (Herbison, Benson, & Martin, 2017; Hoye, Nicholson, & Brown, 2015). Indeed, developing connections with teammates is a critical aspect of sport involvement (Smith, 2019; Ullrich-French & Smith, 2009). Smith (2019) argues that, alongside peer-specific constructs such as developing friendships with teammates, researchers should also consider peer-*group* constructs that reflect the social structure of a team. However, not all sport groups are equal: Some teams may entail greater opportunities to develop relationships and, even within the same team, some athletes may form more social connections than others. The social structure of a group and individual members' positions within that group may shape the extent that members internalize their group membership as an important aspect of their self-identity.

A Social Network Approach to Examine Social Ties in Small Groups

Common methods for studying groups entail assessing individuals' perceptions of the group environment in ways that rarely capture the full complexity of a group's structure or members' unique positions within those groups. In contrast with traditional survey approaches, researchers can use social network analysis as a theoretical and methodological approach to map social ties between members of small groups as a network. Relational

networks are specifically constructed as a representation of the ties connecting group members, and are critical to parse out the latent aspects of groups, including: (a) an individual's perceptions of connections with group members, (b) social connections that other members report with that member, and (c) the broader social structure of ties connecting members as a complete group. Networks reflecting relational ties within small groups are thus useful to construct indices that reflect members' position in the group (e.g., being closely connected to others representing status or popularity) as well as the group structure as a whole (e.g., how tightknit a group is relative to other groups).

The building blocks of relational networks are social ties; connections that link two people in some specific way (Wuchty, 2009). Because the ties that connect members can be assessed through numerous observational or reporting approaches, social ties may reflect many different forms of relations such as friendship or information sharing (McLaren & Spink, 2019). The distinct *types* of social ties used to connect members impact the meaning of a network and determine relevance to key outcome variables. In particular, educational researchers have demonstrated that students' reports of connections regarding how frequently they *interact* with each member of their classroom predict unique variance from their reports of connections regarding the strength of *friendship* with each classmate (Rubin, Bukowski, & Brett, 2009). These insights align with seminal psychometric research in social network analysis, revealing that the strength of social connections should be conceptualized along two aspects: (a) time spent interacting with one another and (b) depth/closeness of a relationship (Marsden & Campbell, 1984). Pertaining to the closeness dimension, 'friendship' ties are widely accepted as an ideal indicator of a strong and emotionally intimate social tie (Marsden & Campbell, 1984). Capturing the social ties between members of a network enables researchers to compute network-based constructs that are highly descriptive for group research.

In addition to characterizing a group's structure based on the number and strength of social connections among its members (i.e., density), social network approaches can also identify individual member's positions within a group, based on both the number and strength of self-reported connections to other members (i.e., outdegree centrality) as well as the number and strength of incoming nominations of connections from fellow members (i.e., indegree centrality; Robins, 2015). Indegree centrality is a highly-descriptive sociometric measure because it is derived from the incoming nominations of teammates, which entails information that could not be gathered by relying solely on outdegree centrality. Whereas individuals are sensitive to inclusion and exclusion in groups, they may not have access to the ways that teammates perceive their social ties. Indegree centrality is thus a distinct construct that is particularly well suited to indicate status or popularity within a network comprised of relational ties, and may have a more subtle (yet meaningful) association with individuals' perceptions of their group membership. Indeed, whereas sport-specific research has revealed leadership quality using team members' reports of one-another's leadership attributes (Fransen et al., 2015), measuring centrality based on social affiliations (e.g., friendships) or interactions denotes a generalized form of social status or importance compared to other members.

With this in mind, the value of a social network approach is highlighted by the ability to examine social dynamics of groups at both the individual- and group-level, as well as the ability to consider an individual's own perceptions of social ties alongside of his or her fellow group members' perceptions of ties. Capturing these varying perspectives aligns with a multifaceted framework of peer relationships (forwarded from Rubin, Bukowski, & Parker, 2006), which holds peer experiences in sport groups must be considered across several levels of social complexity (Holt, Black, Tamminen, Fox, & Mandigo, 2008; Smith, 2007). Specifically, affiliation with peers takes place at the following levels, which are increasingly complex: (a) the individual (e.g., one's social orientation), (b) interactions (e.g., treating others affably or having frequent face-to-face discussions), (c) relationships (e.g., developing close friendships), and (d) the group as a whole (e.g., networks of interrelated social connections such as a sport team). These levels are hierarchical in that an individual brings their own orientations and dispositions into a social exchange that subsequently impacts the nature of a relationship, which is situated within a larger network of peer connections that are all interrelated.

Although currently under-utilized within sport and exercise research, social network approaches often entail advanced sociometric-based methodologies to consider how connections among members in a social context influence attitudes, beliefs, and behaviors (Valente, 2010). Social network theory is thus a valuable framework for studying how the complex structures and compositions of sport teams – in terms of athletes' ties with teammates – may relate to athletes' social identification. Recently, researchers used network methodology to study how social interactions among 185 practitioners of a large and diffuse martial arts network may relate to social identification and adherence with the martial arts club (Rodrigues, Evans, & Galatti, 2019). The results of this study indicated that members with relatively higher indegree centrality reported stronger social identification and were more likely to continue involvement in the club at a 7-month follow-up (Rodrigues et al., 2019). As this research studied a single, large, network, it is critical to understand how social ties may relate to perceptions of social identification within small sport groups that feature rich and unique social ecologies. Sampling numerous groups enables between-group analyses to make inferences related to the effects of group structure on social identity. Moreover, Rodrigues and colleagues' findings were based on binary interactions denoting which members had interacted, which may not be as reflective of social identification as weighted ties that represent the strength of ties or the nature of that tie (i.e., friendship).

The Current Study

Building on literature suggesting that social identification may be associated with one's perceptions of their group environment (Bruner et al., 2015; Martin et al., 2017), we currently used a social network approach to examine how group structure and members' centrality relate to perceptions of social identification strength in *club-level college sport teams*. Club sport provides a rich context for examining relational networks in small groups where members share social identities. However, club sport is also an important context to study, considering that it has the potential to impact the health of over two-million U.S. college students participating on a club sport team each year (Pennington, 2008). Club sport is specifically a platform for college students to continue competing at a high level while

providing opportunities to be physically active and socialize with peers. Alongside the physical health benefits of remaining in sport, involvement in co-curricular clubs or organized social groups is broadly beneficial for college students including greater psychological well-being and greater psychosocial development (Doerksen, Elavsky, Rebar, & Conroy, 2014; Foubert & Urbanski, 2006). In particular, sport club participation is associated with health-related quality of life – even more so than other forms of physical activity (Eime, Harvey, Brown, & Payne, 2010). While being a rich context to investigate how features of social networks relate to identification, this research was valuable to examine how social ties within club-level college sport may relate to the meaning athletes ascribe to their involvement.

We currently examined social networks of college club sport teams along two distinct forms of social ties: (a) Time spent with each teammate outside of club sport activities (hereafter referred to as 'social interactions') and (b) the strength of friendship with each teammate. Although ties are often considered as binary (e.g., friend or not friend), we operationalized ties as weighted to enable participants to distinguish how strong their perceived ties were (e.g., friendship strength; Borgatti, 2013). This was critical because a goal of this research was to examine social identification in relation to the *quality* of social connections with teammates. Whereas social network approaches often explore one large network, the current study considered each team as a unique and closed network. Capturing numerous small group networks enabled us to explore between-group effects regarding variability in teams' group structure. Though under-utilized in sport research, this approach has been used in educational psychology for investigating classrooms as distinct social networks (e.g., Rodkin & Ahn, 2009).

Unique networks were created for each type of social tie, entailing social interactions outside of sport contexts along with more subjective reports of friendship. These ties were then used to compute the following network-based constructs: (a) *outdegree centrality:* individuals' perceptions of connections with teammates, (b) *indegree centrality:* teammates' perceptions of connections with the individual, and (c) *team density:* a group-level indicator of how tight-knit the group's social structure is. As it pertains to study hypotheses, we anticipated that outdegree and indegree centrality, as well as team density would all be positively related to the three dimensions of social identification (i.e., ingroup ties, ingroup affect, and cognitive centrality), though the strength of association may vary across these dimensions. That is, we hypothesized that socially connected team environments, at the group-level, would relate to social identification in addition to individual-level centrality indices. Given the novelty and descriptive aims of this research, no contrasting hypotheses were made for: (a) whether social interaction or friendship ties would be more closely related to social identification, or (b) the nature of associations across identification dimensions. Regarding associations with dimensions of identification, earlier research reported that more central members perceived higher ingroup ties (Rodrigues et al., 2019); as perceptions of connections with teammates, ingroup ties are closely conceptually linked to centrality in particular. Nevertheless, we also anticipated that ingroup affect and cognitive centrality would be related to network indices.

Method

Participants

Participants were club-level college athletes *(N* = 852; 63% female) from 35 intact same-sex teams at a large university in the Northeast United States. Mixed-sex teams were not included because of logistical and methodological constraints. Numerous sports were represented in this sample, including both traditional American intercollegiate sports (e.g., soccer, ice hockey, track and field) as well as competitive sport activities that are less commonplace (e.g., twirling, bowling, water polo, team handball). The mean team size was 24.34 members (*SD* = 12.66) ranging from 5 (Men's Racquetball) to 67 (Women's Western Equestrian). Median team size was 25 members. Participants primarily identified as white (82%), and comprised 30% freshmen, 22% sophomores, 24% juniors, 21% seniors, and 2% graduate students. All participants provided informed consent and ethical approval was obtained from the institutional review board prior to recruitment.

Procedures

Researchers met with intact teams before or after scheduled practices to provide an overview of the study and invite participation. Surveys were administered using electronic tablets or participants' smart-phone devices. As incentive, participating athletes could choose to receive either a $5 gift card or to have their participation count as community service credit towards the number of hours that this university requires for membership on club teams. Using team rosters that are publicly available through the university's Club Sports Program, the percentage of team participation was computed as the number of study participants divided by team size, with an average participation rate of 74.15% *(SD* = 0.22). Whereas this rate approximates existing expectations of response rates required to represent comparable social networks within school classrooms (e.g., Serdiouk, Berry, & Gest, 2016), we expect that this rate also underestimates actual participation rates. Notably, the rosters included all members who had signed up for each club sport and included students who were not actively engaged members. For reference, an average of 50.31% of rostered members who did not complete surveys received no incoming nominations from teammates, which is a likely indicator that this student was not an active member. In sum, participation rates were adequate to conduct network analyses.

Measures

Social Ties.—Nominations of social ties were measured in order to produce networks, from which critical network constructs could be derived (i.e., outdegree centrality, indegree centrality, team density). Participants used a roster nomination survey to indicate weighted ties to each fellow member on the team as a unique rating. This entailed presenting participants with a list of all team members alongside Likert-type response options to indicate the strength of social connection with each member. The first item (i.e., social interactions) asked participants to rate the sentence *'I spend time with this teammate outside of club sport activities'* on a scale ranging from 0 *(Not at all)* to 4 *(All the time)*. Marsden and Campbell (1984) encourage researchers to adjust 'time spent' indicators to avoid potential biases such as overestimation of ties stemming from instances where individuals systematically spend time together. For example, they recommend having co-workers report

on time spent together *outside of work*. In line with these suggestions, and to avoid biases stemming from some teams practicing more or having more games than others, we opted to specify social interactions as those taking place outside of sport. The second item (i.e., friendship) asked participants to rate the sentence *'I consider this person to be among my very closest friends at [University Name]'* from 0 (*Not at all*) to 4 (*Absolutely*). There was also an option to write-in the name and complete sociometric items for any member not listed on the roster (e.g., new members). Participants were instructed that leaving an item blank would score the item as a '0'. Similar sociometric items are commonly used in educational psychology to study classroom networks (e.g., Serdiouk et al., 2016).

Social Identification.—Athletes' strength of social identification was assessed using Bruner and Benson's (2018) Social Identity Questionnaire for sport. Aligned with Cameron's (2004) multidimensional conceptualization of social identity, this nine-item scale entails three subscales: Ingroup ties (e.g., *'I feel strong ties to other members of this team '*), ingroup affect (e.g., *'Generally, I feel good when I think about myself as a team member '*), and cognitive centrality (e.g., *'In general, being a member of this team is an important part of my self-image '*). Response options range from 1 *(Strongly disagree)* to 7 *(Strongly agree)*.

Statistical Analyses

Preliminary analyses entailed computing (a) means and standard deviations of study variables, (b) multilevel bivariate correlations between variables, and (c) intraclass correlation coefficients that indicate the amount of between-group variance in each variable. Confirmatory factor analysis was used to test the three-factor conceptualization of social identification within the current sample (i.e., lavaan package in R; Rosseel, 2012). This entailed accounting for clustering by correcting standard errors to reduce the inflation of type-1 error. Finally, multilevel reliability indices were computed to estimate internal consistency at the between- and within-group levels.

Computing outdegree centrality, indegree centrality, and team density.—An initial step was to produce networks for each team and calculate social network indices using the 'statnet' package in R (Handcock, Hunter, Butts, Goodreau, & Morris, 2008). Team density scores reflect the number and strength of actual ties within a team divided by the highest potential number and strength of ties. For example, a team of 10 athletes has 45 potential ties [$n \times (n-1) / 2$]. Because we examined weighted ties ranging from 0 to 4 in strength, we then multiplied by 4, meaning that the total potential number and strength of ties for a team of 10 would be 180. Pertaining to individual indices, we calculated outdegree (i.e., total number and strength of *self-reported* ties) and indegree centrality (i.e., total number and strength of *incoming* ties). Team-by-team matrices entailing reported ties were used for completing network analyses (i.e., horizontal rows indicating outgoing nominations, vertical rows indicating incoming nominations). To avoid penalizing participants' outdegree scores by deleting ties with nonresponders (i.e., members who did not complete the survey), outdegree centrality was computed using matrices of complete team rosters, including rostered members who did not complete the survey (Žnidaršič, Ferligoj, & Doreian, 2018). Meanwhile, to avoid penalizing indegree and team-level density, non-responders were

removed so that indegree centrality and density scores were computed using matrices that only included team members who participated in the survey (Žnidaršič et al., 2018). To adjust network indices in relation to varying team sizes, raw centrality indices were standardized at the within-team level. Figure 1 provides example sociograms that reflect visualizations of team density as well as individual centrality indices.

Regression analyses.—Multilevel approaches that focused on decomposing within-and between-group patterns were employed to account for interdependencies that emerge when data is nested within teams, both during preliminary analyses (e.g., reliability indices and bivariate correlations) and when conducting regressions critical for hypothesis-testing. Multilevel models were fit hierarchically to test the relative effects of outdegree centrality, indegree centrality, and team-density; allowing intercepts to vary randomly by team. Step 1 considered participant sex, length of tenure with team, and team size as theoretically-relevant control variables. Because social identification was anticipated to most closely relate to individuals' outdegree centrality because of their shared source (i.e., self-reported), these variables were entered in Step 2, followed by indegree centrality in Step 3, and team density in Step 4. Whereas alternative stepwise approaches may be well-suited for sequentially identifying significant predictors, this hierarchical set of regression steps was derived from theory. Specifically, based on the multifaceted framework of peer relationships (Holt et al., 2008; Smith, 2007), we focused on the relative contribution of network indices progressing across levels of increasing social complexity (Rodkin & Ahn, 2009). Relative effects of each step were examined by computing ΔR^2 values.

Results

Descriptive statistics are displayed in Table 1. Confirmatory factor analysis (accounting for the nested data structure) confirmed that the three-factor model of social identity fit the data well: CFI = 0.970, RMSEA = 0.083, SRMR = 0.038. Factor loadings were significant for each item onto the specified latent subdimensions (>.85; $p < .001$). All three subdimensions of social identification demonstrated strong reliability at both the between- and within-group levels: Ingroup ties ($\alpha = .99_B$; $.90_w$), ingroup affect ($\alpha = .99_B$ & $.91_w$), and cognitive centrality ($\alpha = .99_B$ & $.86_w$). Shown in Table 1, intraclass correlation coefficients revealed that between-team variability accounted for between 5 and 10% of the variance in social identification constructs, and between 11 and 44% of the variance in athletes' degree centrality. See Table 1 for multilevel bivariate correlations decomposing associations into between- and within-group levels.

It is also pertinent to consider a descriptive overview of the team networks. Pertaining to team social structure, there was considerable variability in group-level density scores (see Figure 1 for example sociograms). Density in social interaction ranged from 0.34 to 1.76 with an average across groups of 0.96. The density for friendship ranged from 0.33 to 1.52 with an average of 0.86 (i.e., the maximum possible density is 4.0, if all members rated every other member with a '4'). Raw outdegree centrality scores ranged from 0 to 196 for social interaction and from 0 to 172 for friendship. Raw indegree centrality ranged from 0 to 88 for social interaction and from 0 to 58 for friendship.

Pertaining to the multilevel models, recall that we expected outdegree and indegree centrality, as well as team density, to all be uniquely and positively associated with social identification strength. After controlling for sex, team size, and tenure in Step 1, network variables were entered hierarchically to examine their relative effects (Table 2). First, examining the ΔR^2 values across the models, we note that each set of independent variables explained a unique portion of the variance in social identification strength across all three subdimensions. That is, incoming nominations of social ties (i.e., indegree) explained social identification above and beyond outgoing self-reported nominations (i.e., outdegree). Moreover, at the group level, team density explained additional variance beyond what was explained by centrality indices (i.e., positive ΔR^2). This pattern indicates that group structures may exert additional influence on social identification above and beyond the relationships that are self-reported by any single member.

For the control variables entered in Step 1, length of tenure showed a significant positive association with social identification strength, but neither sex nor team size were related. In Step 2, outdegree friendship was positively related to all three dimensions of social identification, whereas outdegree social interaction was only related to ingroup ties. Pertaining to incoming nominations from teammates, Step 3 revealed that indegree social interaction was positively related to ingroup affect and cognitive centrality, while indegree friendship was positively related to ingroup ties. Finally, at the team-level, density of friendship ties was not related to any social identification dimension, whereas density derived from social interaction ties was positively related to ingroup ties and ingroup affect dimensions.

Examining the R^2 values from the final models, we note that the various network indices of social ties among teammates explained a substantial amount of variance in social identification dimensions, with the most variance being explained in the ingroup ties dimension. We also compared the intraclass correlation coefficients from the unconditional null models (reported in Table 1) with those from the final models in Step 4. The extent that the intraclass correlation coefficients decrease from null to final models indicates the amount of group-level variance that was explained by the model. Across all three social identification dimensions, the models accounted for at least 20% of the group-level variance (Table 2).

Discussion

Early social identity theorizing posited that individuals' emergent perceptions of their groups are influenced by evaluations of close ties to fellow members (Turner, 1982). Sport is a domain where participants build social connections with peers within small groups – often serving as a salient source for social identification that is associated with positive outcomes for individuals and groups (e.g., psychological health and well-being; Jetten et al., 2014). Although understudied, the ties among members can produce networks with complex features, with potential implications for social identification. We examined how social connections among teammates— including group-level indices of team environments— relate to athletes' strength of social identification. Using social network analysis within a multilevel framework, we tested the hypothesis that outdegree centrality (i.e., self-reported

social ties), indegree centrality (i.e., incoming nominations of social ties), and team-level network density would each positively relate to social identification strength. A central and overarching finding was that strength of social ties with teammates positively related to athletes' social identification strength. However, the patterns of findings varied in relation to different types of social ties used to produce networks (friendship or interaction) and the three dimensions of social identification.

In line with recommendations from network theorists, we examined social ties along two distinct but related dimensions: Time spent together outside of sport and the perceived strength of friendship (Marsden & Campbell, 1984). Regarding self-reported outdegree centrality, friendship ties were positively related to all three dimensions of social identity, whereas ties pertaining to interactions with teammates only significantly related to the ingroup ties dimension of social identification. Conversely, for incoming nominations of social ties (after accounting for the effects of outdegree centrality in the previous step), indegree friendship centrality was significantly associated with the ingroup ties dimension, while indegree interaction centrality was associated with the ingroup affect and cognitive centrality dimensions. Whereas the outdegree centrality findings highlight the importance of perceiving teammates as close friends, these findings are novel in that incoming nominations of being more central within team social interactions related to stronger social identification in terms of viewing one's group membership as a positive and important aspect of the self. Friendship perceptions, though often considered in terms of reciprocity, may be more relevant in the eye of the beholder, whereas the value of dense interactions with others are more deductive and can be mapped from incoming nominations. Nevertheless, these data indicate that both friendship and interaction ties are relevant to different aspects of social identification.

It is also pertinent to consider differences across the three dimensions of social identification. Recall that ingroup ties reflects one's feelings of bonding and similarity to other members, ingroup affect reflects how positively one feels about their group membership, and cognitive centrality reflects how important one's group membership is to her/his self-concept (Cameron, 2004). We expected that ingroup ties would strongly relate to indices of centrality – as these constructs are conceptually quite similar – and these expectations were supported. Meanwhile, findings pertaining to ingroup affect and cognitive centrality were particularly novel. In particular, those who self-reported more friendship ties (i.e., outdegree centrality) reported feeling more positively about group membership and viewed that membership as more central to their self-concept. While not all task-performing small groups foster friendships, these findings indicate that establishing deeper relationships with fellow members may be related to how individuals view and identify with the group.

Findings related to indegree centrality also varied across the dimensions of identification. Whereas being nominated as a central member in terms of friendship related to the ingroup ties dimension, high indegree centrality in interaction networks related to ingroup affect and cognitive centrality. One explanation for this pattern relates to distinctions between interaction and friendship nominations. Theorists who study adolescent peer networks observe that friendship networks are valuable for reflecting close affiliations (i.e., acceptance, preference, likeability), whereas networks derived from amount of interaction or

overt assessments of perceived popularity align more closely to members' status in relation to impact, visibility, or dominance (Lease, Musgrove, & Axelrod, 2002; van den Berg, Burk, & Cillessen, 2015). Through this perspective, it is plausible that indegree centrality in interaction networks produced an estimation of the visibility of a member, whereby central members more readily derive positive affect and importance from group membership.

A message from across these findings is that although outdegree and indegree centrality are each derived from the same set of relationships among members, each contributes unique information (Valente, 2010). The value in utilizing a social network approach was indeed demonstrated by the current findings as indegree nominations reflecting generalized importance or status within the group, related to social identification in ways that were distinct from self-reported ties. Nevertheless, findings regarding both indegree and outdegree centrality combine to reveal the value of social ties, which aligns with the social identity approach where it is expected that members who feel socially disconnected often do not have their needs satisfied and feel less connected with the group (Tajfel, 1974). Meanwhile, social identity theorists emphasize that member connectedness within groups increases the extent to which individuals identify with that group (Hogg, 1996; Stryker & Burke, 2000), which was indeed supported within the current study; albeit without the ability to test the direction of this theorized association.

Alongside individuals' unique social position within a group, identity theorists also emphasize that the interconnectedness of a social network, as a whole, impacts the strength of members' social identification (Stryker & Burke, 2000). Particularly when considering the capacity to contrast effects at individual- and group-levels, a key consideration of this study relates to the use of a multilevel framework. To this point, outdegree and indegree centrality reflect individual members' positions, while examining *density* allowed us to test the association between belonging to a highly socially connected (or unconnected) group and the strength of members' social identification with that group. The current findings indicated that team density in terms of interaction networks – but not friendship networks – was positively related to ingroup ties and ingroup affect dimensions of social identification. Given that this group-level effect was significant after previously accounting for individual-level centrality, affiliating with a socially connected group may facilitate positive emergent perceptions of social identification regardless of a member's position within their respective team's social structure. Teams that spend more time together may feel more like a true group, which aligns with recent research that has found that perceptions of groupness are linked to more positive affective valence in the group and stronger identification with that group (Graupensperger et al., 2019; Martin et al., 2017). This was particularly evident in the finding that more densely connected teams related to greater ingroup affect.

Limitations

Alongside the strengths of the current study, such as using a sophisticated network methodology to provide an in-depth examination of social ties among sport teammates, several limitations must be considered. First, we acknowledge that social identity is likely to have bidirectional associations with aspects of the group environment. In other words, we acknowledge that group members who identify strongly with a group will experience

motives to foster closer connections with other members. Given the cross-sectional nature of these data, the direction of effects must be considered cautiously. Our analytic decisions were nevertheless informed by theory. The nature of network measures also supported our approach, as indegree centrality and density indices are derived from teammate nominations of previous social interactions (or absence) and were thus considered to have temporal precedence (i.e., interactions and friendship develop prior to taking the survey). Nevertheless, we recommend the use of longitudinal analyses in the future to examine how identities and social ties shape one another reciprocally over time.

A second limitation is that, although there are benefits to sampling a wide variety of sport types, heterogeneity across networks presents certain challenges that may present artifacts. Whereas we were able to control for some between-group differences, such as team size, other aspects such as differences in the frequency of competition or practices would be relevant to consider in terms of social identification. Lastly, as it pertains to our methodological approach using social network analysis to capture social ties among teammates, we chose to use a weighted-ties approach, rather than binary, to enable participants to distinguish how strong their perceived ties were. Although this is a theoretical and empirically justified approach (Newman, 2004), it cannot perfectly distinguish those group members who have a large number of weak ties from those who have a smaller number of very strong ties. Such knowledge would be valuable to further unpack whether social identification strength varies between those who have greater generalized status versus those who are highly popular within a smaller clique or subgroup of the team (e.g., Martin, Wilson, Evans, & Spink, 2015).

Conclusion

We employed a social network approach to examine the association between social ties among teammates on college club sport teams and perceptions of social identification strength. The current findings provide evidence that self-reported social ties, incoming nominations of social ties, and team-level social connectivity are all positively related to aspects of athletes' social identities. Considering existing evidence that social identification has positive outcomes, such as mental health and well-being (Jetten et al., 2014), there may be practical and translational value in examining whether fostering social ties within collegiate networks can indeed promote such benefits. As such, future longitudinal and experimental work is needed to build upon these early-stage observational findings. Alongside these theoretical and practical contributions to a growing social identity in sport literature, the current study highlights the utility in using social network approaches to study sport teams and similar small group environments. Whereas commonly employed survey methods are limited to aggregated self-reports of perceptions of group environments, social network approaches consider unique information relating to incoming sociometric nominations of social ties, as well as more detailed descriptions of a group's social structure.

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Highlights and Implications

- Athletes who have relatively more social connections with teammates reported identifying more strongly with their team.
- Athletes reported stronger social identity perceptions when they belonged to teams that were more densely connected in terms of social connections among teammates.
- The results of the current study highlight the methodological advantages of using social network analysis to study sport teams and other relatively small groups.
- Although additional research is required to support directional inferences (i.e., teammate interactions leading to social identification, rather than vice versa), a positive association between network connections and social identity strength may nevertheless inform stakeholders' efforts to enhance the social environment of a sport team.

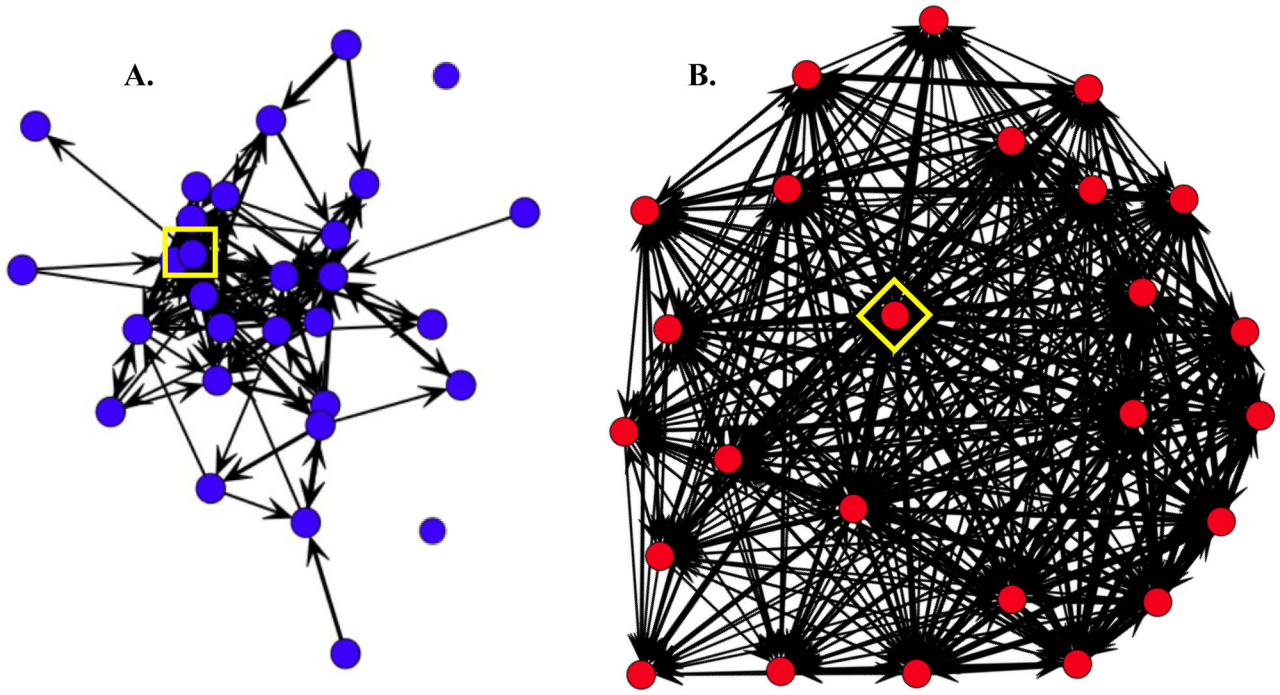

Figure 1.

Example sociograms of the teams with lowest density (A – on left; 0.34) and highest density (B – on right; 1.76) pertaining to time spent together outside of sport – the social interaction item. Line width indicates strength of tie and arrows represent direction of tie. Note that the low-density group included numerous members who were considered isolates (i.e., no incoming or outgoing nominations) or pendants (i.e., only a small number of outgoing nominations), along with several members with numerous strong ties. To demonstrate the nature of centrality values, Figure 1A includes a node within the yellow box, which had a standardized outdegree centrality of 2.67 (raw score = 65) and indegree centrality value of .82 (raw score = 15). Meanwhile, the node highlighted within the yellow diamond in Figure 1B had a standardized outdegree centrality of 2.42 (raw score = 86) and indegree centrality value of .53 (raw score = 46).

Table 1.

Multilevel bivariate correlations and descriptive statistics.

	1	2	3	4	5	6	7	8	9	10	11	12
1. Ingroup Ties	**(.07)**	.66**	.49**	.39**	.38**	.44**	.45**	--	--	--	--	.34**
2. Ingroup Affect	.70**	**(.05)**	.50**	.17**	.17**	.23**	.22**	--	--	--	--	.08*
3. Cognitive Centrality	.69**	.78**	**(.10)**	.22**	.23**	.28**	.26**	--	--	--	--	.17**
4. Outdegree Friendship	.64**	.28	.39	**(.11)**	.63**	.42**	.43**	--	--	--	--	.36**
5. Outdegree Interaction	.65**	.26	.39	.90**	**(.16)**	.41**	.38**	--	--	--	--	.35**
6. Indegree Friendship	.68**	.33	.43*	.90**	.79**	**(.42)**	.93**	--	--	--	--	.55**
7. Indegree Interaction	.74**	.36	.46*	.85**	.89**	.94**	**(.44)**	--	--	--	--	.59**
8. Density Friendship	.77**	.48**	.39	.47**	.60**	.59**	.73**	**(1.0)**	--	--	--	--
9. Density Interaction	.84**	.55**	.47**	.60**	.63**	.74**	.81**	.95**	**(1.0)**	--	--	--
1. Sex (1 = Male, 2 = female)	.13	.26	.25	.06	−.10	.18	.10	−.12	.01	**(1.0)**	--	.04
11. Team Size	−.20	−.21	−.10	.34	.05	.30	.03	−.37	−.27	.12	**(1.0)**	--
12. Tenure	.40*	.27	.17	.25	.14	.35	.32	.50**	.55**	.18	−.07	**(.00)**
Mean (*SD*)	5.47 (1.24)	6.20 (.88)	5.22 (1.32)	21.99 (24.82)	27.53 (26.70)	16.88 (13.25)	21.42 (16.34)	.80 (.36)	.92 (.41)	—	24.34 (14.27)	2.73 (1.69)

Note: Between-group correlations are below the diagonal, within-group correlations are above diagonal, and intraclass correlation coefficients are on the diagonal in bold. Group-level variables have no variance at the within-group level, and are thus excluded. Indegree and Outdegree variables are in their raw format where nominations of social ties ranged from 0 to 4 for each teammate (i.e., maximum score = 4 × number of teammates). Team density ranges from 0 to 4. Social identity subscales range from 1 to 7.

Table 2.

Hierarchical multilevel regressions predicting strength of social identity (N = 852).

Fixed Effect	Ingroup Ties	Ingroup Affect	Cognitive Centrality
Step 1:	R^2 = .11 / .17	R^2 = .02 / .05	R^2 = .03 / .12
Sex $_{(M = 1, F = 2)\ \gamma 01}$	.03 (.11)	.15 (.10)	.18 (.12)
Team Size $_{\gamma 02}$	−.02 (.06)	−.05 (.05)	.00 (.07)
Tenure $_{\gamma 10}$	.33 (.03)***	.09 (.03)*	.16 (.03)***
Step 2:	ΔR^2 = .11 / .12	ΔR^2 = .03 / .04	ΔR^2 = .05 / .06
	LRT = 130.07***	LRT = 31.37***	LRT = 48.93***
Sex $_{(M = 1, F = 2)\ \gamma 01}$	.07 (.11)	.19 (.10)	.21 (.13)
Team Size $_{\gamma 02}$	−.03 (.07)	−.07 (.05)	−.01 (.07)
Tenure $_{\gamma 10}$	.17 (.03)***	.00 (.04)	.05 (.05)
Outdegree Friendship $_{\gamma 20}$	**.21 (.04)*****	**.15 (.05)****	**.19 (.05)*****
Outdegree Interaction $_{\gamma}$	**.21 (.04)*****	**.08 (.05)**	**.09 (.05)**
Step 3:	ΔR^2 = .03 / .04	ΔR^2 = .03 / .04	ΔR^2 = .02 / .02
	LRT = 47.67***	LRT = 27.28***	LRT = 20.91***
Sex $_{(M = 1, F = 2)\ \gamma 01}$	.08 (.12)	.20 (.10)	.22 (.13)
Team Size $_{\gamma 02}$	−.04 (.07)	−.07 (.06)	−.01 (.07)
Tenure $_{\gamma 10}$	.04 (.04)	−.11 (.04)*	−.04 (.04)
Outdegree Friendship $_{\gamma 20}$	.18 (.04)***	.11 (.05)*	.15 (.05)***
Outdegree Interaction $_{\gamma 30}$	.16 (.04)***	.03 (.05)	.05 (.05)
Indegree Friendship $_{\gamma 40}$	**.19 (.09)***	**.03 (.10)**	**−.01 (.09)**
Indegree Interaction $_{\gamma 50}$	**.08 (.09)**	**.20 (.09)***	**.21 (.09)***
Step 4:	ΔR^2 = .08 / .00	ΔR^2 = .03 / .00	ΔR^2 = .03 / .00
	LRT = 42.56***	LRT = 15.85**	LRT = 9.87**
Sex $_{(M = 1, F = 2)\ \gamma 01}$	.04 (.07)	.14 (.09)	.16 (.12)
Team Size $_{\gamma 02}$	.01 (.04)	−.05 (.05)	.01 (.07)
Tenure $_{\gamma 10}$	.02 (.04)	−.12 (.04)**	−.05 (.04)
Outdegree Friendship $_{\gamma 20}$	.18 (.04)***	.12 (.05)*	.16 (.05)***
Outdegree Interaction $_{\gamma 30}$	.16 (.04)***	.03 (.05)	.05 (.05)
Indegree Friendship $_{\gamma 40}$	.20 (.09)*	.04 (.10)	.00 (.09)
Indegree Interaction $_{\gamma 50}$	.08 (.08)	.20 (.09)*	.21 (.09)*
Density Friendship $_{\gamma 03}$	**−.09 (.31)**	**−.36 (.41)**	**−.33 (.55)**
Density Interaction $_{\gamma 04}$	**.74 (.26)****	**.72 (.34)***	**.70 (.46)**
Final Model R^2	.33 / .33	.11 / .13	.13 / .20
Final ICC (% explained)	.01 (86%)	.02 (60%)	.08 (20%)

Note: Bold rows indicate that variable was added in the current step. R^2 values are marginal and conditional, respectively. Marginal R^2 is based only on fixed effects, while conditional R^2 is based on fixed and random effects. LRT = Likelihood Ratio Test, which indicates significant improvements in model fit from one step to the next.

* $p<.05$

** $p<.01$

*** $p<.001$.