

Team Dynamics: A Social Network Perspective

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Research has consistently revealed that team cohesion is positively related to team performance under certain conditions. In response to the need for understanding this relationship more fully, and because of the promising new insights that can be garnered with the use of social network analysis (SNA), this study employs SNA as a tool to explore a case study of the structural cohesiveness of two women's collegiate basketball teams. Members of the two teams completed online roster-based surveys related to different types of structural cohesion levels at four points during the season. This case study revealed that the higher performing team showed improved structural cohesion in the efficacy network over the four phases, and highlighted the movement of key players in the different networks (friendship, trust, advice, and efficacy) over time. These patterns demonstrate the potential for SNA to function as a diagnostic tool for organizations and researchers to generate testable hypotheses even in instances where statistical inference may be precluded by sampling constraints. In short, SNA was found to be a valuable new tool for exploring, depicting, and informing explanations about the individual relationships that impact team dynamics.

Dynamics of Team Cohesion: A Social Network Perspective

While tangible factors are easier to identify and measure, intangible factors are frequently a critical determinant of team performance in the sport context (Curtner-Smith, Wallace, & Wang, 1999; Pickens, 1994; Voight & Callaghan, 2001). Some sport teams seem to perpetually under-perform, while only a relative few appear to function with the utmost efficiency and effectiveness. What accounts for this disparity in team performance is typically the subject of vigorous debate among media, fans, coaches, and athletes (cf. Curtner-Smith et al., 1999; Whannel, 2002). However, the respective accolades or blame are frequently attributed to individual performance, with little regard given to the group as a functional unit (Whannel, 2002). Aside from traditional mainstream, overt factors such as variance in coaching ability, player talent, and critical in-game decisions, researchers have shown that group cohesion, which is often less perceptible, may also impact performance (Carron, Colman, Wheeler, & Stevens, 2002; Heuzé, Sarrazin, Masiero, Raimbault, & Thomas, 2006).

Carron, Brawley, and Widmeyer (1998) defined cohesion as "a dynamic process that is reflected in the tendency for a group to stick together and remain united

in the pursuit of its instrumental objectives and/or for the satisfaction of member affective needs" (p. 213). Widmeyer, Carron, and Brawley (1993) determined that 83% of the studies conducted in the area of cohesion found a positive correlation between cohesion and group performance. Therefore, understanding the relationship between cohesion and performance and the factors that either foster or inhibit cohesion would benefit sport managers and/or coaches in pursuit of high performance.

For the past two decades, nearly all research conducted in the area of team cohesion has used the conceptual framework introduced by Carron, Widmeyer, and Brawley (1985). To help define, categorize, and measure levels of cohesion, the model developed by Carron et al. divides cohesion into four dimensions: group integration-task (GI-T), group integration-social (GI-S), individual attractions to the group-task (ATG-T), and individual attractions to the group-social (ATG-S). Cohesion within this framework has been evaluated based on the widely-used Group Environment Questionnaire (GEQ), an 18-item self-report inventory anchored on a 9-point Likert-type scale. While this framework is extensively used within the sport psychology literature, few have explored alternative tools that may provide new insight and more illustrative ways to evaluate team dynamics. Within the more general management literature, a body of research known as social network analysis (SNA) provides potentially revelatory metrics for the measurement of the individual relationships that comprise the social entities to which people belong. In fact, Quatman and Chelladurai (2008) characterized SNA as "a new and promising research lens to the field of sport management" (p. 339).

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In response to these potential new insights, this study utilizes SNA as a tool to explore the structural cohesion of two collegiate basketball teams. SNA provides insight into the structure of a team, specifically the dyadic relationships. In the sport psychology literature, team cohesion has been conceptualized as a property of teams, one that emerges from the interactions of team members, but one that coalesces into a holistic group property that cannot be reduced to its lower level elements (e.g., Carron et al., 1985; Carron et al., 1998). This type of cohesion might be similar to the atoms that make up the structure of a molecule, where the atoms coalesce into a single unit and the molecule is the only meaningful level of interest (see Dansereau, Alluto, & Yammario, 1984). Similarly, individuals could coalesce into a team, and the actions and performance of the team as a whole becomes the unit of analysis. This approach to cohesion helps us understand groups as a holistic unit and the outcomes related to group-level functioning.

SNA, by contrast, examines cohesion at both the individual and the group level and is interested in process and structure, individuals and the group, and also the various relationships within the group. Structural cohesion—the term used in the SNA literature to reflect the density of a network—examines the emergent compilation of relationships between network members in both part and whole. In the words of Kozlowski and Klein (2000):

This type of perspective attempts to understand how the dynamics and interactions of lower-level elements unfold over time to yield structure or collective phenomena at higher levels. This perspective is not a reversion to reductionism; rather, it is an effort to comprehend the full complexity of a system—its elements, their dynamics over time, and the means by which element in dynamic interaction create collective phenomena. (p. 16)

Thus, both perspectives—emergent as whole, and emergent as part *and* whole—are compatible, but different. In fact, it is possible that the kind of structural cohesion studied with an SNA approach could be an antecedent to “team cohesion” as a holistic property and could provide insight into the dynamics behind such shared unit-level behavior.

Through the use of a roster-based adjacency matrix survey, SNA differs from the GEQ and most other instruments in that it is tailored to each individual group or team. As Wasserman and Faust (1994) noted, “From the view of social network analysis, the social environment can be expressed as patterns or regularities in relationships among interacting units” (p. 3). In addition to these relational concepts, the authors also identified four unique characteristics of SNA that substantiate how this tool provides a departure from other empirical tools. First, SNA assumes that actors and their actions are interdependent rather than independent, autonomous units. Second, relational ties between actors are assumed to be channels through which both tangible and intangible resources may flow or

be transferred. Third, network models view the structural environment of the network as having the potential to either constrain or enable individual agency. Fourth, network models conceptualize the structure of the network as the expression of lasting patterns of individual relationships. Wasserman and Faust also asserted that a social network analyst would “seek to model these relationships to depict the structure of a group. One could then study the impact of this structure on the functioning of the group and/or the influence of this structure on individuals within the group” (p. 9). Therefore, SNA measures can provide a useful tool to better understand team dynamics, individual roles within the group, and network evolution while concomitantly elucidating issues related to organizational cohesion, effectiveness, and performance. As a result, this study uses a case to introduce and demonstrate the viability of SNA for examining team dynamics and structural cohesion.

Quite simply, “The man who correctly understands how a particular structure works can prevent it from working or make it work differently with much less effort than a man who does not know these things” (Bailey, 2001, p. 187). In the case of athletic teams, equipping a coach with knowledge of a team’s oft-imperceptible relationships and structures should yield similar benefits. That is, a coach with knowledge of the intricacies and key relational structures within his or her team can more effectively lead the team to success. Utilizing a longitudinal SNA design, this case study not only depicts the various social networks within the teams, but also begins to address a number of underdeveloped theoretical areas including: (a) the evolution of social networks over the course of a season, (b) the role that specific individuals play within the networks, and (c) the relationship of various networks with team performance. While a discussion of the case context and specific results are warranted to fully appreciate SNA, it must be understood that the focus of this study is on SNA and its application, not necessarily on the intricacies and in-depth analysis of the case itself.

Review of Literature

Team Performance

The relationship between team performance and cohesion seems an obvious one. As levels of cohesion rise, so should team performance. The same is true for the corollary: as team performance improves, the levels of cohesion should continue to increase. In fact, Martens and Peterson (1971) illustrated this circular relationship in one of the first empirical studies ever conducted in the area of team cohesion. The research focused on a large sample of intramural athletes and measured the effect that team cohesiveness had on individual player satisfaction levels and overall team performance. The results indicated a strong relationship between levels of team cohesiveness and team performance, implying that teams with higher levels of perceived cohesion are more likely to succeed, and more successful teams are in turn

more cohesive. Numerous studies have since supported this connection across many different types of sports (for recent examples, see Heuzé, Raimbault, & Fontayne, 2006; and Magyar, Feltz, & Simpson, 2004).

Despite corroborating this same relationship, Carron et al. (2002) alluded to the lack of explanatory insight found in the literature. Ostensibly, what the authors referred to was that although the relationship between cohesion and performance has been established, an examination of mediating (explanatory) variables is necessary to better understand the cohesion-performance relationship. Heuzé, Raimbault, and Fontayne (2006) noted that the relationship between performance and cohesion necessitates an examination of potential mediators, while understanding the conditions that give rise to the performance-cohesion relationship requires an exploration of potential moderators. Although, to this point, the literature has failed to adequately address which mediators and moderators have the most significant impact, there exists strong evidence that collective efficacy can often be an important mediator of the relationship between cohesion and performance. Logically, “players in more cohesive teams may hold stronger shared beliefs in their team’s competence, which in turn may lead to greater team success. And group performance success may increase players’ perceptions of collective efficacy, which in turn may contribute to the development of cohesion” (Heuzé et al., 2006, p. 61). Some research indicates, however, that this triadic relationship can often be more complicated and confounding than the linear relationship these scholars described.

Social Network Analysis

Deriving many of its principles from graph theory, SNA utilizes algorithms and procedures that allow a researcher to map social structures that otherwise may be unnoticed. As Wasserman and Faust (1994) explained, SNA provides the analytic tools to “translate core concepts in social and behavioral theories into formal definitions expressed in relational terms” (p. 20). SNA, therefore, can complement and enhance our understanding of multifaceted relationships such as cohesion by aiming to better understand the relational embeddedness and connectedness of social units at the individual, organizational, and/or structural level (Kilduff & Tsai, 2007). In fact, Burt (1980) noted this potential for connecting micro- and macro-level structures as one of the primary benefits of SNA. In this regard, SNA provides a unique empirical tool through which to examine and expand the theoretical contributions of earlier research aimed at understanding team dynamics and structural cohesion. That is, understanding the social structures of a group would lend explanatory power to the perceptions of team dynamics and structural cohesion. Whereas nonnetwork measurements such as Carron et al.’s (1985) GEQ are unable to test theoretical propositions related to structural properties, SNA provides “a collection of descriptive procedures to determine how the system behaves, and statistical methods to test the appropriateness of the proposition” (Wasserman & Faust, 1994, p. 22).

By collecting whole social network data, the centrality of each actor in the network can be determined using a variety of measures, the simplest of which include in-degree (i.e., popularity of an individual), betweenness (i.e., connections to unconnected individuals), and eigenvector (i.e., connections to individuals who are central; Kilduff & Tsai, 2007). In addition, structural cohesion, or the overall connectedness of network, is also frequently analyzed. Toward that end, this study employs SNA as a tool to explore the structural cohesiveness of two women’s collegiate basketball teams over a season.

Method

This study applied established social network cohesion methodologies to a sport-specific case study. In the current study, the researchers measured the levels of cohesion in four specific areas, three of which come directly from the SNA literature (Krackhardt & Hanson, 1996). These three preestablished measures uncovered and explicated the friendship (i.e., I consider this a person a friend), trust (i.e., I trust this person), and advice (i.e., I went to this person for advice) networks of each participant. To build upon and contribute to the traditional literature in this area, we also included a more sport-specific measure of individual (and ultimately collective) efficacy (Spink, 1990). That is, an efficacy criterion (“I felt confident about this person’s basketball-related knowledge and/or ability”) was also included. Combined, these four measures provided insight that extends the depth and scope of current work within the area of cohesion. Although the four constructs are analogous with factors derived from previous research, it is important to differentiate that Carron et al.’s GEQ, for example, is a self-report inventory anchored on a 9-point Likert-type scale that measures an individual’s perceptions of the group’s integration and the individual’s attraction to the group. In contrast, SNA is a tool in which measures are based on explicitly defined relationships between the individual actors. Therefore, although the measures used in the current study reflect an understanding (consistent with previous research) which suggests that cohesion is comprised of both social (in this case, friendship and advice networks, which represent expressive and instrumental social ties, respectively) and task-related (in this case, trust and efficacy networks) components, the actual measures have been reframed to afford an analysis in concert with the SNA literature (cf. McPherson, Smith-Lovin, & Cook, 2001; Mullen & Copper, 1994). (Note: while trust has been defined in numerous ways, recent literature points to trust being a key component of effectiveness, leadership, and performance [e.g., Dirks, 2000; Dirks & Skarlicki, 2009; Dixon & Roach, 2006]. Based on this interpretation, trust was categorized as being task-related.) SNA focuses on the amalgamation of specifically defined dyadic relationships to provide insight into team and group structure and process.

Participants

The participants included members of two NCAA Division-I women's basketball teams who gave their informed consent to take part in the study. Participants received a letter notifying them of the study and making them aware that participation was voluntary and had been approved by institutional human subjects review. Twenty-seven members of Team A (one head coach, three assistant coaches, nine support staff, and 14 players comprised of five starters and nine reserves) and twenty members of Team B (one head coach, two assistant coaches, three support staff, and 14 players comprised of six starters and eight reserves) completed the study. Starters versus reserves were determined based on the end of the year game statistics. Players who started a majority of the games and played the most minutes were classified as "starters." The participants ranged in age from 18 to 45, with the majority being between 18–22 years old. Most of the participants ($n = 43$) were female, but a few of the coaches and support staff were male ($n = 4$).

All members of the teams were asked to participate, including the players, coaches, and support staff (i.e., nonplayers and noncoaches associated with the day-to-day operations of the team, such as directors of basketball operations, administrative assistants, student managers, and athletic trainers). Although the extant literature typically restricts its analysis of cohesion to only the players on a given team, the decision to include coaches and support staff in the analysis was based on the idea that the functioning of a team depends on the synthesis of all its parts—not just the players.

Due to the nature of SNA research, one group of individuals, or in this case one team, would be considered a sufficient sample to conduct an SNA inquiry (Kilduff & Tsai, 2007). However, the additional team allowed for the researchers to compare and contrast the two teams (networks) over the course of a full season. Basketball teams were chosen for analysis due to the nature of the sport being one in which individuals are highly interactively dependent on one another (Carron & Chelladurai, 1981).

The make-up of the two teams was also considered in the research design. Both teams competed in comparable athletic conferences (i.e., "Mid-major" Division-I conferences) and therefore chose to attend somewhat similar colleges. In terms of social status and background the differences between the teams were negligible; however, comparatively, the teams were somewhat demographically distinguishable with regard to the socioeconomic background of the players. That is, the Team A players mostly hailed from suburban middle class geographic areas, while the Team B players tended to be from rural areas characterized by populations with lower socioeconomic classes. During the season in which the teams were surveyed the two teams also diverged in terms on their on-the-court success. Notably, Team A posted a winning

season (.56 winning percentage), tripling their number of wins from the previous year, and recording the school's first postseason victory in over 15 years. Team B, on the other hand, recorded arguably one the school's least successful seasons in 20 years as the team struggled to win even 25% of its games.

Procedure

The two teams completed a short online survey at four critical points during the basketball calendar year. These critical points were based on feedback from both current and former coaches. Those points in time included the off-season (early August), preseason (October/November), following nonconference play or midseason (December/January), and end of season (March). On the roster-based survey, the participants indicated which team members fit a given criteria and provided information related to each of their social networks to track any possible network changes as the season progressed. The criteria employed to generate the four networks were concise, which is consistent with standard network methodology: I went to this person for advice; I trust this person; I considered this person a close friend (regularly got together outside of team functions); I felt confident about this person's basketball-related knowledge and/or ability. Participant responses to these indices were then imported and formatted, as square adjacency matrices comprised of the aggregated responses of each individual regarding his or her teammates.

Data Analysis

After the data were compiled, social network analysis-specific software called UCINET (Borgatti, Everett, & Freeman, 1999) was used to generate indices of cohesion for the advice, trust, friendship, and collective efficacy networks. In this study, structural cohesion was measured using the "density" calculation within the software, which determines the proportion of the number of connections or ties that exist between actors in relation to the number of the maximum possible connections or ties in the network (Kilduff & Tsai, 2007). For example, if all individuals in the network were "isolates" or unconnected, the structural cohesion measure would be zero (.0000); whereas if all actors were connected to one another the structural cohesion for the network would be one (1.000). Specifically, the data were compared with team performance (i.e., winning percentage) to determine if any patterns between these constructs emerged. In accordance with standard SNA practice, visual inspections of the generated networks were also included to assess the data (Kilduff & Tsai, 2007). Although there is not a particular criterion for analysis in the inspection process, conclusions are drawn through cross-referencing the graphical output with both the generated indices and the researcher's intuition (Wasserman & Faust, 1994).

Generated Hypotheses

The following section presents the SNA results for each of the teams in this case study. While the data are introduced in detail to explain the meaning and utility of the different measures, the ultimate goal of this research is to generate hypotheses that could be tested using inferential methods (e.g., teams with a high level of structural cohesion in their efficacy networks will have a higher winning percentage compared with teams with a low level of structural cohesion in their efficacy networks). Examples of the kind of hypotheses that could be generated are presented at the end of this section and throughout the discussion.

Table 1 depicts how the two team networks evolved over the course of a season by highlighting the changes in overall structural cohesion of the different networks and the four critical points in the season. For purposes of demonstration, Tables 2 and 3 provide the individual in-degree centralities (i.e., the number of incoming ties) that comprise the overall structural cohesion scores of each team in the efficacy networks. Combined, these tables illustrate the unique composition of an SNA perspective relative to other measures that are traditionally employed. As each of these tables confirms, only slight fluctuations over the course of the season are observed. The only distinct patterns to have emerged were the steady increase of structural cohesion in Team A's efficacy, trust, and advice networks as the season progressed (see Table 1).

Figures 1, 2, 3, and 4 all graphically represent the off-season and postseason social networking maps of the two teams. A line between two actors indicates a relationship exists and the arrowhead represents the direction of the relationship. If a relationship were reciprocated

the line would have an arrowhead on both ends (e.g., the reciprocal tie between two bench players (B2 and B3) in the Off-Season network depicted in Figure 3). An example of a unidirectional tie can be seen in the Off-Season network of Figure 1, where a line exists between HC to S5 with an arrowhead pointed at S5. This indicates that for the efficacy criteria (I felt confident about this person's basketball-related knowledge and/or ability) the head coach (HC) affirmed this feeling about the particular starter (S5). However, this relationship was not reciprocated by S5 because an arrow is not going from S5 with the arrowhead pointed at HC. Again, the number of incoming ties (i.e., in-degree centrality) is typically the most telling social networking measure when evaluating the cohesiveness of a network (Balkundi & Harrison, 2006).

Figures 1, 2, 3, and 4 also visually depict the changes that occurred at the individual actor-level over the course of a season. For example, Figures 1 and 2 highlight the efficacy of the teams. In the efficacy networks for both teams, the head coach (represented by the yellow triangle) moves from a central location during the off-season to a decentralized location at the end of the season. Another change that emerges pertains to the starting players (see Figure 3). Comparing the off-season to postseason, Figure 3 demonstrates how the starters formed somewhat of a clique (i.e., a group that interacts with one another, but has few common links to others) represented on the left-hand side of the postseason graph.

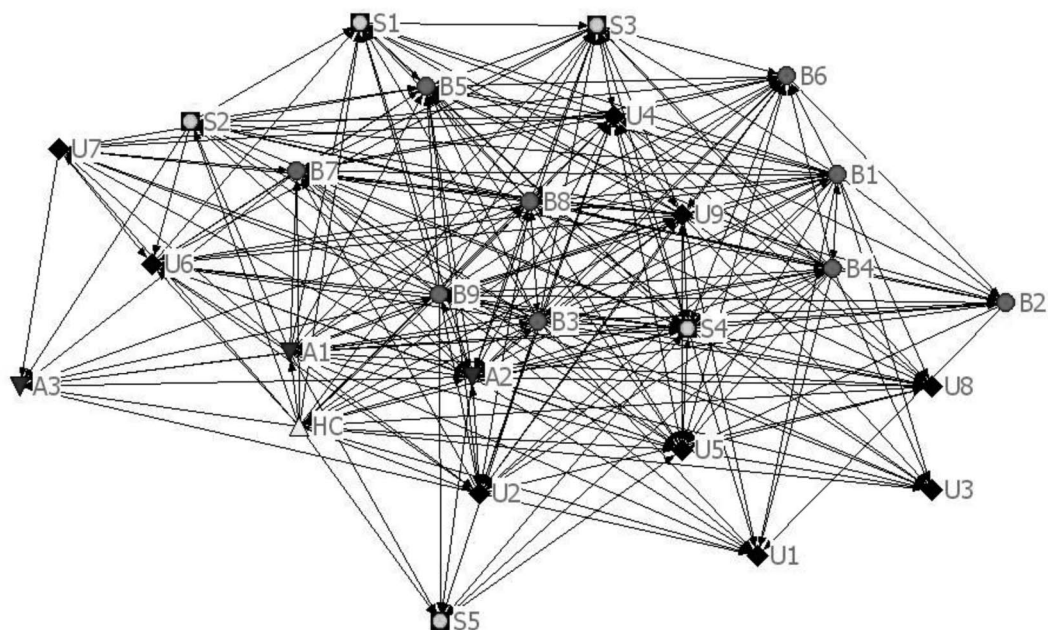
With regard to team performance, a comparison of the overall team structural cohesion measures in Table 1 demonstrates how one might begin to generate hypotheses about the cohesion-performance relationship. The

Table 1 Longitudinal Cohesion Measures of Efficacy, Trust, Friendship, and Advice Networks

Team	Off-Season	Pre-Season	Mid-Season	Post-Season	
	Efficacy	Efficacy	Efficacy	Efficacy	Mean Efficacy
Team A	0.4569	0.4719	0.5272	0.6062	0.5156
Team B	0.2881	0.2719	0.3125	0.2596	.2955
	Trust	Trust	Trust	Trust	Mean Trust
Team A	0.4554	0.4349	0.5449	0.5440	0.4948
Team B	0.313	0.269	0.3092	0.3614	0.3131
	Friendship	Friendship	Friendship	Friendship	Mean Friendship
Team A	0.1892	0.1820	0.1651	0.2179	0.1886
Team B	0.1717	0.2573	0.2368	0.2632	0.2492
	Advice	Advice	Advice	Advice	Mean Advice
Team A	0.1677	0.1716	0.1779	0.2509	0.1920
Team B	0.1524	0.1725	0.3059	0.2351	0.2355

- Starter
- Bench Player
- △ Head Coach
- ▼ Assistant Coach
- ◆ Support Staff

Off-Season



Post-season

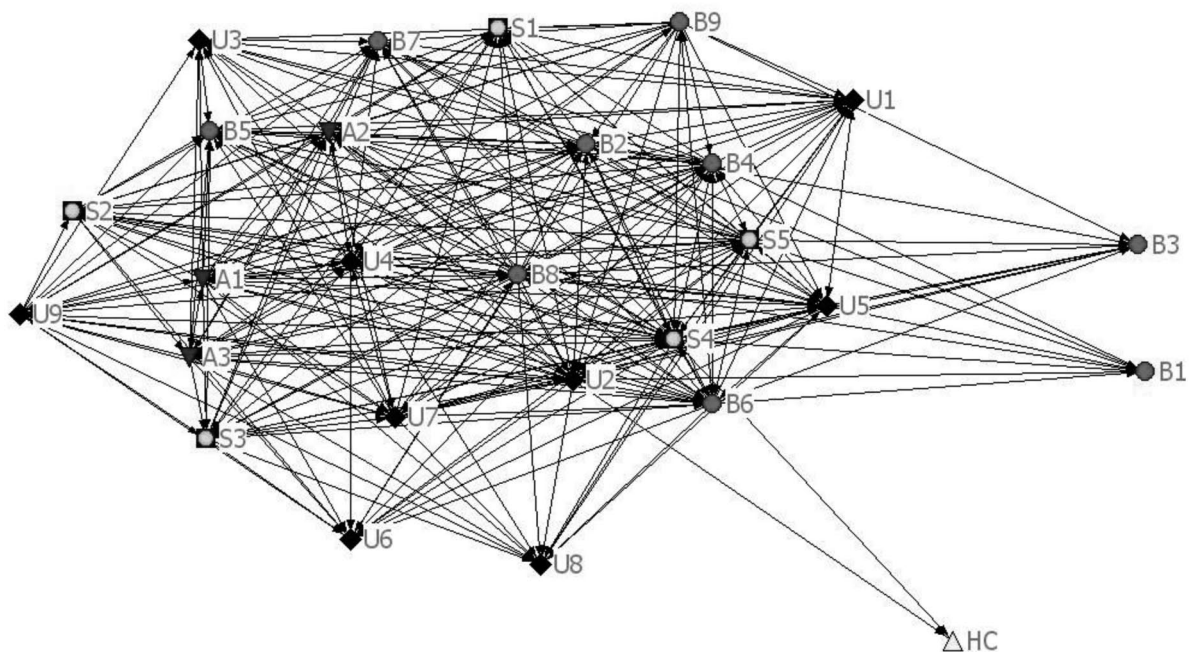


Figure 1 — Example of Efficacy Network, Off-Season and Post-Season (Team A)



Off-Season

Post-Season

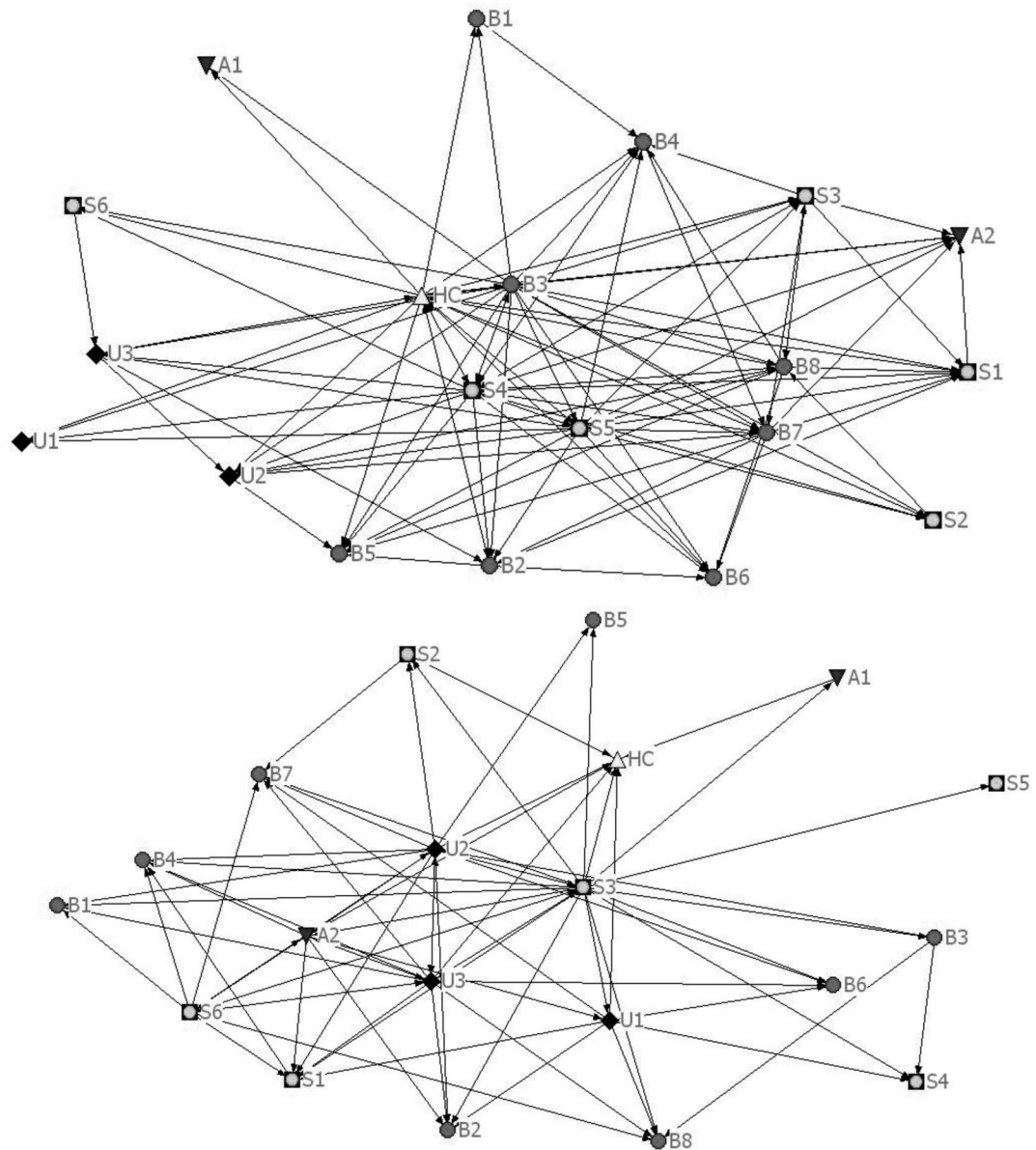


Figure 2 — Example of Efficacy Network, Off-Season and Post-Season (Team B)

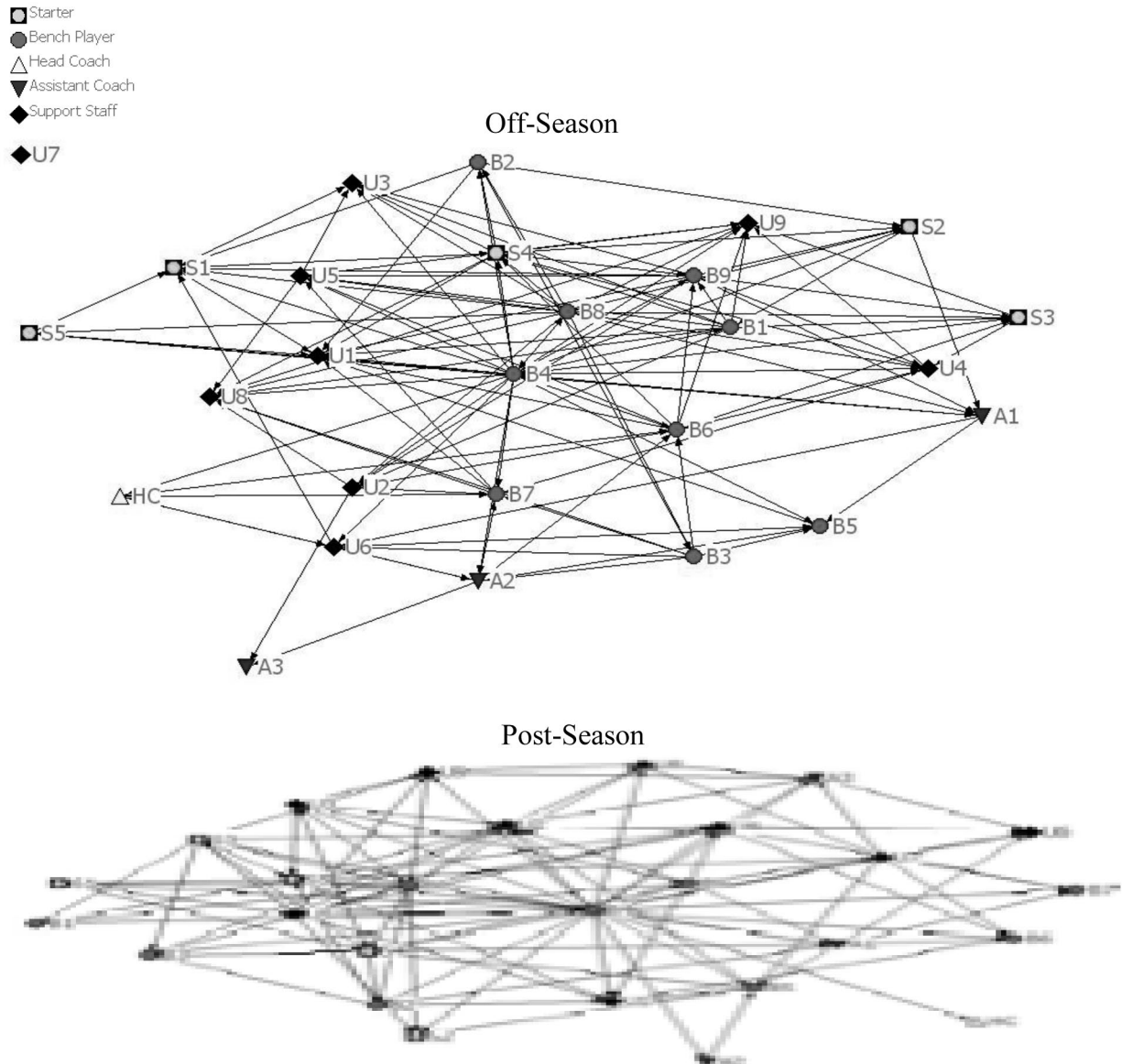


Figure 3 — Example of Friendship Network, Off-Season and Post-Season (Team A)

data indicate that the better performing team, Team A, reported the highest levels of structural cohesion on the efficacy and trust networks. Team A started the season with a 0.4569 structural cohesion measure on the efficacy network and ended the season at 0.6062; Team B, the less successful team, started at 0.2881 and ended at 0.2596 on this same network measure. This phenomenon can also be observed through comparing Figures 1 and 2. These figures show that Team A has a much denser (i.e., more cohesive structure, as indicated by more connections) network than Team B. A similar pattern emerged within the trust network. Team A started the season at 0.4554 on this network, and ended the season with a slightly higher cohesion measure of 0.5440. Team B, on the other hand,

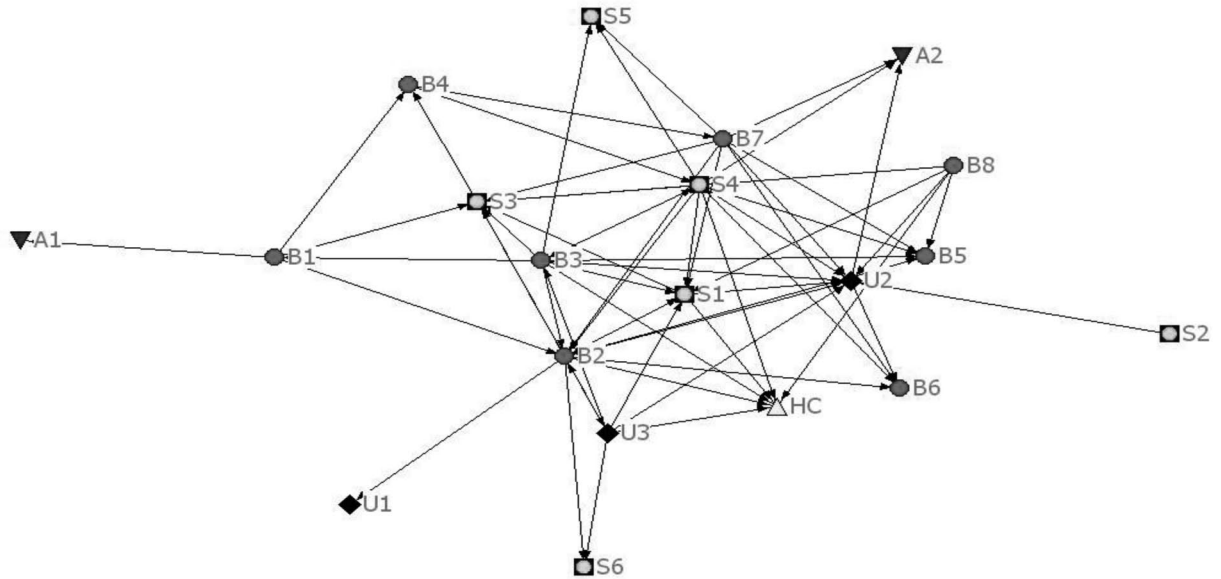
started with a 0.3130 structural cohesion measure on the trust network and ended the season at 0.3614.

A different pattern, however, was observed within the Friendship and Advice networks. In both of these networks the mean structural cohesion measures over the course of the season were higher for Team B, the less successful team. For the friendship network, Team B had a 0.2492 mean structural cohesion measure while Team A was only at 0.1886. On the advice network the measures were 0.2355 and 0.1920, respectively.

These observations, in combination with the existing literature, help form the basis for the hypotheses that a positive relationship likely exists between structural cohesion on the efficacy and trust networks and team

- Starter
- Bench Player
- △ Head Coach
- ▼ Assistant Coach
- ◆ Support Staff

Off-Season



Post-Season

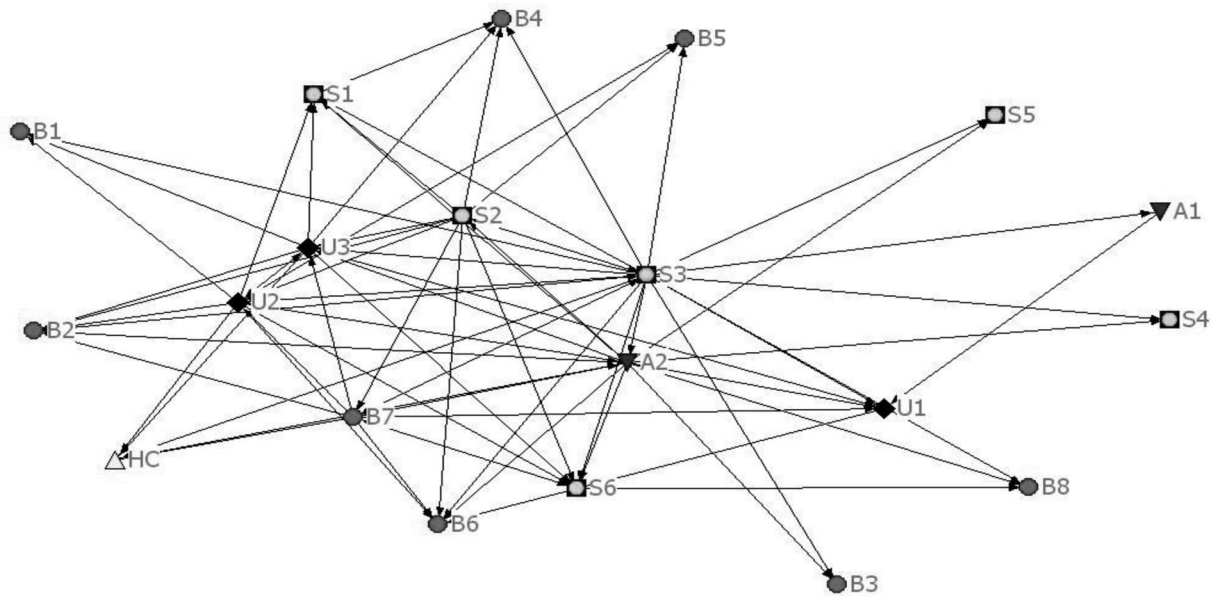


Figure 4 — Example of Friendship Network, Off-Season and Post-Season (Team B)

performance, while a negative relationship would likely be found between structural cohesion on the friendship and advice networks and team performance. That is, these two cases suggest that increases in team cohesion based on efficacy and trust should improve team performance, while increases in cohesion based on friendship and advice would negatively impact team performance. Future research with a larger sample, however, is necessary to confirm this supposition. For example, a simple linear regression model would need to be constructed to determine if structural cohesion scores could predict performance. The structural cohesion scores of the efficacy, trust, friendship, and advice networks on a large sample of teams would serve as independent variables to predict winning percentage over time.

Discussion

In considering the impact of these findings both in terms of a case study demonstrating SNA methodologies and a contribution to the existing work on team dynamics, a number of compelling implications may be gleaned. One of the most salient findings is the evidence of how a network evolves and changes over time; in this case, over the course of a basketball season. Another contribution of this work to the study of team cohesion comes from the potential for SNA approaches to generate a multitude of examinations and hypotheses from the same data set through the combination of individual scores, group measures, and graphical depictions of the network. Utilizing SNA allows for the possibility of extensive individual- and group-level measures that statistically corroborate and elaborate the visual representation of the networks (e.g., in-degree centrality and overall group structural cohesion). By visually and quantitatively comparing the networks at different stages of the season, meaningful changes in the networks can be detected. This approach offers the potential for new theoretical and practical insights into the formation and structure of team networks.

Therefore, measuring structural cohesion with SNA allows a researcher to visually depict a team network in a manner that not only shows the overall structural cohesiveness of a team or network, but also demonstrates each individual actor's role, position, and centrality within a network. This method is useful in that it allows researchers to deconstruct the team network down to the individual level (cf. Kozlowski & Klein, 2000). From a practical standpoint, this data are incisive in that it can uncover network structures that are not typically observable to a coach or manager, while doing so in a manner that is heuristically simple for a practitioner who may have little theoretical knowledge of team cohesion measures. Consequently, this knowledge could then strategically be used to assist a coach or manager in identifying the potential opportunities and obstacles to creating a more structurally cohesive team. For example, if a team's network map (i.e., visual map of the aggregated dyadic ties; see Figures 1–4 for examples) indicates that a player

is on the outer perimeter of the team's trust network, a coach could use this information as a diagnostic tool to identify and mitigate potential interpersonal conflict through the use of his or her managerial acumen and leadership training.

This study builds upon Carron et al.'s (1985) work in that while it can be used to further describe and evaluate the team environment as a whole, it also begins to answer the call in Carron et al.'s (2002) work for a measurement tool that provides more nuanced insights and explanatory potential. Carron et al.'s (1985) Group Environment Questionnaire would likely have also shown that Team A was the more cohesive team. However, by using SNA, researchers are able to generate an assessment of the team that is grounded in explicitly defined actor-to-actor relationships rather than a perception of the general environment. For example, the importance of structural cohesiveness within the efficacy and trust networks over time was demonstrated within this study, further substantiating the potential of these variables to mediate cohesion levels. Perhaps even more telling were the simple visual depictions of the relationships in the networks. Based on an analysis of these graphs, a researcher can visually inspect the dyadic relationships within team and the overall density of the network at different points, and more importantly, show which individual actors are central to the network at different points of the season. Often the importance of these key individuals in terms of serving as links in the organizational chain is unobservable without the aid of a tool like SNA.

SNA uncovers the patterns of interactions among individuals in a network, and can reveal imperceptible yet crucial connections. Knowledge of such connections could potentially be used by leaders for the betterment of the entire team. For example, most would assume that starters (players that typically receive a majority of the playing time) and head coaches would be central within the efficacy network structures. However, as Figure 1 (as well as Table 2) demonstrates, this was not the case for Team A. Rather, bench players (players that typically see little to no playing time) and support staff were central in this network. This counterintuitive finding reveals important testable hypotheses that go beyond the traditional cohesion measures, and begin to elucidate the mechanisms underlying the dynamics of this team. In this particular case, an SNA approach allows researchers to see not only that the team was structurally cohesive, but also the key roles that bench players and the support staff have in the network. Thus, these potentially overlooked individuals who are often assumed to be ancillary to the operations of a team were the proverbial "glue" holding the team together in this particular case. Without the multifaceted approach afforded through the use of this new analytic tool, this level of revelatory insight would not be possible.

To give another example of how SNA could potentially be used as a diagnostic tool for team cohesion, this study specifically shows how both head coaches

Table 2 Example of Longitudinal In-Degree Centrality for Efficacy Network (Team A)⁺

Individual	Off-Season	Pre-Season	Mid-Season	Post-Season
	In-Degree	In-Degree	In-Degree	In-Degree
S1	14	14	17	16
S2	11	12	14	14
S3	13	13	14	13
S4	16	14	16	18
S5	7	8	11	9
B1	4	6	3	8
B2	11	13	14	13
B3	5	9	10	9
B4	7	11	10	9
B5	19	20	21	20
B6	15	20	18	16
B7	14	19	18	18
B8	10	8	9	8
B9	6	6	6	3
HC	5	8	4	2
A1	8	10	9	11
A2	14	20	18	17
A3	10	8	9	11
U1	11	12	8	9
U2	13	11	12	12
U3	10	12	11	13
U4	13	12	16	17
U5	15	14	13	15
U6	15	12	16	14
U7	7	7	11	13
U8	13	11	11	13
U9	11	9	10	10
<i>Mean</i>	11	11.8	12.2	12.3
<i>SD</i>	3.8	4	4.4	4.3
<i>Min.</i>	4	6	3	2
<i>Max.</i>	19	20	21	20

⁺S = Starter; B = Bench Player; HC = Head Coach; A = Assistant Coach; U = Support Staff

held more central positions in all four of the networks during the off-season only to move to more decentralized positions at the end of the season. Leader Membership Exchange Theory, which espouses the importance of the quality of relationship and connections between an individual and supervisor, could further explain the

significance of this movement. Thus, another potential hypothesis for exploration is that a coach who maintains a more central position within a network structure may indicate a higher quality of Leader Membership Exchange relationships within the team. This is important because in Leader Member Exchange studies such

relationships have been found to be associated with higher levels of performance, commitment, satisfaction, and retention (see Graen & Uhl-Bien, 1995; Schriesheim, Castro, & Cogliser, 1999). Future research should continue to explore the inclusion of external actors (i.e., coaches and support staff) within the measures employed to assess cohesion, and should supplement the analyses with qualitative explanations to better understand the importance of their position within the network. With a larger sample of teams, the individual head coaches' cohesion centrality scores could also be inferentially tested to determine the relationship that exists between these scores and team performance. Again, a simple linear regression model with head coaches' individual cohesion centrality scores serving as the independent variable could be constructed to determine if team performance could be predicted. As Dion (2000) notes, understanding vertical cohesion in addition to the more traditionally measured horizontal cohesion could provide a more comprehensive assessment of a group's overall cohesion. For example, it is possible that a coach may move to the periphery of the network not because of a diminishment in the quality of his/her relationships, but perhaps as a result of empowering players to take a more prominent role in the direction of the team. Without a more nuanced understanding, motivation and leadership strategies may be overlooked.

SNA also demonstrated the emergence of a clique among the starters in Team A (see Figure 3) within the friendship network over the course of the season. From this evidence, it may be hypothesized that the more time interacting on the court help initiate bonds off the court, or perhaps that the positive team performance yielded friendship that did not exist before season.

Additional hypotheses could be generated around the types of cohesion (task and social) and their unique relationships to performance. Previous research has indicated that task cohesion compared with social cohesion is more strongly correlated with work performance (Brawley, Carron, & Widmeyer, 1987; Carless & De Paola, 2000; Mullen & Copper, 1994; Williams & Widmeyer, 1991). Task cohesion can be defined as the motivation or commitment toward common goals (Widmeyer & Williams, 1991), while social cohesion is focused more on interpersonal relationships with other group members. To an extent, the current data support this notion. That is, the structural cohesion measures in the efficacy and trust networks, which could be thought of as more task-oriented networks, were considerably higher in Team A, the better performing team. In other words, the previous findings that assert the importance of task-oriented cohesion were corroborated within these two teams. Team B, the less successful team, however, recorded higher structural cohesion measures for the more socially orientated networks, friendship and advice (Table 3). This may be further support for the notion that task cohesion is a more salient determinant of future performance. It is also important to note

that the efficacy and trust networks were quite similar, thus indicating these networks could be measuring the same construct. Although these results provide slightly more nuanced support for the existing theories that identify task cohesion (instead of social cohesion) as an antecedent for higher performance, the findings also raise questions about the nature of social cohesion, particularly in terms of its purported relationship as a consequence of success. In this study, the higher performing team (Team A) reported consistently low levels of social (advice and friendship) cohesion; in fact, the lower performing team (Team B) reported higher levels of social cohesion than Team A. This suggests that perhaps the relationship between performance and social cohesion may be influenced by other factors. Future research should continue to explore and test these relationships.

Despite the fact that more socially-oriented networks, such as friendship and advice, appeared to not be as strongly related to performance, a coach or sport manager should not dismiss the importance of socially cohesive networks, especially for female athletes. Spink (1995) concluded that social cohesiveness for females was positively related to female athletes' intentions to continue participating in team sports. Similarly, White (1993) discovered that, compared with their male counterparts, female athletes were significantly more team-oriented and placed a greater importance on the social aspect of the team experience. Although the friendship and advice networks did not appear to be strongly related to team performance, future research should consider the impact such networks would have on retention and athlete satisfaction.

Conclusion

As research in team cohesion continues to evolve, researchers can benefit from a multitude of perspectives and tools. While the laudable contributions from Carron and colleagues' (1985) Group Environment Questionnaire continue to provide a useful measurement for team cohesion, the field must continue to advance through the introduction of complementary tools such as those available within an SNA perspective. As with most team cohesion research, socially desirable participant responses may be a limitation. Future research would benefit from synthesizing the relative contributions of the GEQ and SNA, while supplementing these analyses with inferential statistical analyses and qualitative research components. Consequently, the purpose of conducting this exploratory study was not to debunk the valuable advancements that have been made within the realm of team cohesion, nor was it necessarily to provide a complete treatment and analysis of the two specific teams. Rather, the intention of this article was to introduce sport managers and practitioners to a new tool that is at their disposal in the ongoing quest for generating richer explanatory and predictive analyses.

Table 3 Example of Longitudinal Degree Centrality for Efficacy Network (Team B)⁺

Individual	Off-Season	Pre-Season	Mid-Season	Post-Season
	In-Degree	In-Degree	In-Degree	In-Degree
S1	8	7	9	6
S2	4	3	2	2
S3	5	3	4	3
S4	5	3	3	3
S5	4	2	3	1
S6	3	5	6	4
B1	2	4	3	4
B2	6	6	7	5
B3	2	1	0	1
B4	7	7	7	6
B5	8	5	1	2
B6	7	7	8	4
B7	6	6	8	6
B8	6	5	3	5
HC	6	9	7	7
A1	2	1	0	1
A2	7	5	7	4
U1	4	4	4	2
U2	7	7	7	4
U3	5	3	6	4
Mean	5.2	4.7	4.8	3.7
SD	1.9	2.1	2.7	1.8
Min.	2	1	0	1
Max.	8	9	9	7

⁺S = Starter; B = Bench Player; HC = Head Coach; A = Assistant Coach; U = Support Staff

References

- Bailey, F.G. (2001). *Stratagems and spoils: A social anthropology of politics*. Boulder, CO: Westview Press.
- Balkundi, P., & Harrison, D.A. (2006). Ties, leaders, and time in teams: Strong inference about network structure's effects on team viability and performance. *Academy of Management Journal*, 49, 49–68.
- Borgatti, S.P., Everett, M.G., & Freeman, L.C. (1999). UCINET 5.0 Version 1.00. Natick: Analytic Technologies.
- Brawley, L.R., Carron, A.V., & Widmeyer, W.N. (1987). Assessing the cohesion of teams: Validity of the group environment questionnaire. *Journal of Sport Psychology*, 9, 275–294.
- Burt, R. (1980). Models of network structure. *Annual Review of Sociology*, 6, 79–141.
- Carless, S.A., & De Paola, C. (2000). The measurement of cohesion in work teams. *Small Group Research*, 31, 71–88.
- Carron, A.V., & Chelladurai, P. (1981). Cohesiveness as a factor in sport performance. *International Review for the Sociology of Sport*, 16(2), 21–43.
- Carron, A.V., Brawley, L.R., & Widmeyer, W.N. (1998). The measurement of cohesiveness in sport groups. In J.L. Duda (Ed.), *Advances in sport and exercise psychology measurement* (pp. 213–226). Morgantown, WV: Fitness Information Technology.
- Carron, A.V., Colman, M.M., Wheeler, J., & Stevens, D. (2002). Cohesion and performance in sport: A meta analysis. *Journal of Sport & Exercise Psychology*, 24, 168–188.
- Carron, A.V., Widmeyer, W.N., & Brawley, L.R. (1985). The development of an instrument to assess cohesion in sport teams: The Group Environment Questionnaire. *Journal of Sport Psychology*, 7, 244–266.

- Curtner-Smith, M.D., Wallace, S.J., & Wang, M.Q. (1999). Relationship of coach and player behaviors during practice to team performance in high school girls' basketball. *Journal of Sport Behavior*, 22, 203–221.
- Dansereau, F., Alluto, J., & Yammarino, F. (1984). *Theory testing in organizational behavior: The variant approach*. Englewood Cliffs, NJ: Prentice Hall.
- Dion, K.L. (2000). Group cohesion: From “field of forces” to multidimensional construct. *Group Dynamics*, 4, 7–26.
- Dirks, K.T. (2000). Trust in leadership and team performance evidence from NCAA Basketball. *The Journal of Applied Psychology*, 85, 1004–1012.
- Dirks, K.T., & Skarlicki, D.P. (2009). The relationship between being perceived as trustworthy by coworkers and individual performance. *Journal of Management*, 35, 136–157.
- Graen, G.B., & Uhl-Bien, M. (1995). Relationship-based approach to leadership: Development of leader-member exchange (LMX) theory of leadership over 25 years: Applying a multi-level multi-domain perspective. *The Leadership Quarterly*, 6, 219–247.
- Heuzé, J.P., Raimbault, N., & Fontayne, P. (2006). Relationships between cohesion, collective efficacy, and performance in professional basketball teams: An examination of mediating effects. *Journal of Sports Sciences*, 24(1), 59–68.
- Heuzé, J.P., Sarrazin, P., Masiero, M., Raimbault, N., & Thomas, J.P. (2006). The relationships of perceived motivational climate to cohesion and collective efficacy in elite female teams. *Journal of Applied Sport Psychology*, 18, 201–218.
- Kilduff, M., & Tsai, W. (2007). *Social networks and organizations*. London: Sage.
- Kozlowski, S., & Klein, K. (2000). A multilevel approach to theory and research in organizations: Contextual, temporal, and emergent processes. In K. Klein & S. Kozlowski (Eds.), *Multilevel theory, research and methods in organizations* (pp. 3–90). San Francisco: Jossey-Bass.
- Krackhardt, D., & Hanson, J.R. (1996). Informal networks: The company behind the chart. In L. Prusak (Ed.), *Knowledge in organizations* (pp. 37–50). Newton, MA: Butterworth-Heinemann.
- Magyar, T.M., Feltz, D.L., & Simpson, I.P. (2004). Individual and crew level determinants of collective efficacy in rowing. *Journal of Sport & Exercise Psychology*, 26, 136–153.
- Martens, R., & Peterson, J.A. (1971). Group cohesiveness as a determinant of success and member satisfaction in team performance. *International Review of Sport Sociology*, 6, 49–61.
- McPherson, M., Smith-Lovin, L., & Cook, J. (2001). Birds of a feather: Homophily in social networks. *Annual Review of Sociology*, 27, 415–444.
- Mullen, B., & Copper, C. (1994). The relations between group cohesiveness and performance: An integration. *Psychological Bulletin*, 115, 210–227.
- Pickens, M. (1994). Game location as a determinant of team performance in ACC basketball during 1900–1991. *Journal of Sport Behavior*, 17, 212–217.
- Quatman, C., & Chelladurai, P. (2008). Social network theory and analysis: A complementary lens for inquiry. *Journal of Sport Management*, 22, 338–360.
- Roach, K., & Dixon, M.A. (2006). Hiring internal employees: A view from the field. (XXX). *Journal of Sport Management*, 20, 137–158.
- Schriesheim, C.A., Castro, S.L., & Coglisier, C.C. (1999). *Leader-member exchange. LMX*. research. (XXX). A comprehensive review of theory, measurement, and data-analytic practices. *The Leadership Quarterly*, 10, 63–113.
- Spink, K.S. (1990). Group cohesion and collective efficacy of volleyball teams. *Journal of Sport & Exercise Psychology*, 12, 301–311.
- Spink, K.S. (1995). Cohesion and intention to participate of female sport team athletes. *Journal of Sport & Exercise Psychology*, 17, 416–427.
- Voight, M., & Callaghan, J.A. (2001). Team-building intervention program: Application and evaluation with two university soccer teams. *Journal of Sport Behavior*, 24, 420–432.
- Wasserman, S., & Faust, K. (1994). *Social network analysis: Methods and applications*. Cambridge: University of Cambridge Press.
- Whannel, G. (2002). *Media sports stars: Masculinities and moralities*. London: Routledge.
- White, S.A. (1993). The relationship between psychological skills, experience, and practice commitment among collegiate male and females skiers. *The Sport Psychologist*, 7, 49–57.
- Widmeyer, W.N., Carron, A.V., & Brawley, L.R. (1993). Group cohesion in sport and exercise. In R.N. Singer, M. Murphy, & L.K. Tennant (Eds.), *Handbook of research on sport psychology* (pp. 672–692). New York: Macmillan.
- Widmeyer, W.N., & Williams, J.M. (1991). Predicting cohesion in a coaching sport. *Small Group Research*, 2, 548–570.
- Williams, J.M., & Widmeyer, W.N. (1991). The cohesion-performance outcome relationship in a coaching sport. *Journal of Sport & Exercise Psychology*, 13, 364–371.