

Siri, W. (1961). Body composition from fluid spaces and density: Analysis of methods. 1961. *Nutrition*, 9(5), 480-492.

Solaja, A., Milankov, A., Pejakovic, S., & Stokic, E. (2017). Body composition of the Serbian national track and field team. *Medicinski Pregled*, 70(3-4), 87-94. doi:10.2298/mpns1704087s

Thompson, M. A. (2017). Physiological and biomechanical mechanisms of distance specific human running performance. *Integrative and Comparative Biology*, 57(2), 293-300. doi:10.1093/icb/ix069

Thuany, M., Gomes, T. N., & Almeida, M. B. (2020a). Fatores associados ao desempenho em corredores de rua. *Revista Carioca de Educação Física*, 15(2), 51-59.

Thuany, M., Gomes, T. N., & Almeida, M. B. (2020b). Is there any difference between "amateur" and "recreational" runners? A latent class analysis. *Motriz, Rio Claro*, 26(4), e10200140. doi:10.1590/S1980-65742020000400140

Thuany, M., Gomes, T. N., Estevam, L. C., & Almeida, M. B. d. (2021). Crescimento do número de corridas de rua e perfil dos participantes no Brasil. In *Atividade física, esporte e saúde: Temas emergentes* (Vol. 1, pp.127-136). Belém, PA, Brasil: Rbf editora. doi:10.46898/rfb.9786558890980.9

Thuany, M., Gomes, T. N., Hill, L., Rosemann, T. J., Knechtle, B., & Almeida, M. B. d. (2021). Running performance variability among runners from different Brazilian states: A multilevel approach. *International Journal of Environmental Research and Public Health*, 18(7), 3781. doi:10.3390/ijerph18073781

Weltman, D. Snead, R. Seip, R. Schurrer, S. Levine, R. Rutt, ... Rogol, A. (1987). Prediction of lactate threshold and fixed blood lactate concentrations from 3200-m running performance in male runners. *International Journal of Sports Medicine*, 8(6), 401-406. doi:10.1055/s-2008-1025694

Willy, R., & Paquette, M. (2019). The physiology and biomechanics of the master runner. *Sports Medicine and Arthroscopy Review*, 27(1), 15-21. doi:10.1097/JSA.0000000000000212

AUTHORS:

João Bernardo Martins ¹
 José Afonso ¹
 Ademilson Mendes ¹
 Leticia Santos ¹
 Isabel Mesquita ¹

¹ Centro de Investigação, Formação, Inovação e Intervenção em Desporto (CIFI2D), Faculdade de Desporto, Universidade do Porto, Portugal.

<https://doi.org/10.5628/RPCD.21.02.59>

Inter- and intra-team variability in game patterns: A narrative review.

KEYWORDS:

Performance analysis. Match analysis. Inter-team variability. Intra-team variability. Team sports.

SUBMISSÃO: 20 de Janeiro de 2021

ACEITAÇÃO: 13 de Maio de 2021

ABSTRACT

The purpose of this narrative review was to evaluate the game patterns variability in team sports, that is, how game patterns differ across and within different performance levels. We synthesized match analysis-derived knowledge addressing variability in game patterns and conceptually organized the findings into an umbrella framework to help researchers better situate future investigations and highlight gaps that should be addressed by the literature. We structured the study of game pattern variability under five dimensions: (a) inter-team variability based on sex/gender; (b) inter-team variability due to competitive level; (c) inter-team variability within the same competitive level; (d) inter- and intra-team variability due to positional status; and (e) intra-team variability within the same positional status. Relevant gender-based differences in game patterns are identified, but researchers often publish data on men and women separately, inhibiting more direct comparisons. Game pattern variability is present across different competitive levels and, more interestingly, also within the same competitive level, allowing different performance models to coexist at the highest levels of competition. There is variability emerging from the different positional status of the players, but also intra-team variability within the same positional status. Overall, the study of game patterns variability can be divided into (at least) five different, but complementary dimensions, each affording valuable knowledge to improve coaches' understanding of the game dynamics.

CORRESPONDING AUTHOR: João Bernardo Martins. CIFI2D, Faculdade de Desporto, Universidade do Porto. email: joao_10z@hotmail.com

Variabilidade inter- e intra-equipa nos padrões de jogo: Uma revisão narrativa

RESUMO

O objetivo desta revisão narrativa foi avaliar a variabilidade dos padrões de jogo nos desportos de equipa, isto é, como os padrões de jogo diferem entre e dentro de diferentes níveis de desempenho. Sintetizámos o conhecimento derivado da análise de jogo abordando a variabilidade nos padrões de jogo e organizámos as suas dimensões num quadro concetual para auxiliar os investigadores a situar melhor as investigações futuras e a destacar lacunas que devem ser abordadas pela literatura. Estruturámos o estudo da variabilidade dos padrões de jogo em cinco dimensões: (a) variabilidade inter-equipas baseada no sexo/género; (b) variabilidade inter-equipas emergente do nível competitivo; (c) variabilidade inter-equipas dentro do mesmo nível competitivo; (d) variabilidade inter- e intra-equipa devida ao estatuto posicional; e (e) variabilidade intra-equipa para um mesmo estatuto posicional. Foram identificadas diferenças relevantes baseadas no género nos padrões de jogo, mas os investigadores frequentemente publicam dados sobre homens e mulheres separadamente, inibindo comparações mais diretas. A variabilidade dos padrões de jogo está presente em diferentes níveis competitivos e, mais interessante, também dentro do mesmo nível competitivo, permitindo que distintos modelos de desempenho coexistam nos mais altos níveis de competição. Existe variabilidade derivada do estatuto posicional dos jogadores, mas também dentro do mesmo estatuto posicional. No geral, o estudo da variabilidade dos padrões de jogo pode ser dividido em (pelo menos) cinco dimensões diferentes, mas complementares, cada uma proporcionando conhecimento valioso para melhorar a compreensão dos treinadores sobre a dinâmica do jogo.

PALAVRAS-CHAVE:

Análise da performance. Análise de jogo. Variabilidade inter-equipa. Variabilidade intra-equipa. Desportos de equipa.

INTRODUCTION

Variability is inherent to motor control (Schorer, Baker, Fath, & Jaitner, 2007) and human behavior in general (Caballero, Davids, Heller, Wheat, & Moreno, 2019). Consequently, variability is relevant to understanding sports performance (Canossa, Abrales, Estriga, Fernandes, & Garganta, 2020; Kempton, Sirotic, & Coutts, 2014). Variability has been studied in fields as diverse as psychology (Gamaldo, An, Allaire, Kitner-Triolo, & Zonderman, 2012), computer science (Inacio, Barbetta, & Dantas, 2017) and sports sciences (Chryssanthopoulos et al., 2015; Pyne, Trewi, & Hopkins, 2004). In sports sciences, the literature has provided different approaches to the study of variability, including but not limited to: (a) variability in motor control and parameters of individual actions (Schorer et al., 2007); (b) variability motivated by, or associated with, the manipulation of task constraints (Caballero et al., 2019); (c) inter-team variability in physical performance (Kempton et al., 2014); and (d) variability in biomechanical parameters (Canossa et al., 2020). Variability can also be analyzed from the perspective of emerging game patterns in team sports, which will be the focus of this review, as it represents a less well explored avenue of research within the topic.

The study of variability is a hot topic in performance analysis (PA) but is not as well established in match analysis (MA). MA can provide an important route for extending the understanding of variability and its manifestations, providing relevant performance indicators (Gregson, Drust, Atkinson, & Salvo 2010) that will enable coaches to engage with more diversified and creative solutions to the competitive demands (Davids, Araújo, Correia, & Vilar, 2013; Silva et al., 2015). Recognizing the role of variability in game patterns means respecting the diversity of individual and collective characteristics that pervade sports (Clemente, Couceiro, Martins, Mendes, & Figueiredo, 2015; Nia & Ali Besharat, 2010). Research in MA has focused on variability in the efficacy of game actions (Castellano & Pic, 2019; Higham, Hopkins, Pyne, & Anson, 2014) and in emergent game patterns (Hurst et al., 2016; Laporta, Afonso, & Mesquita, 2018a, 2018b). However, results have typically been used to establish general models, providing a skewed view of reality, and obfuscating relevant inter-team differences.

Within the topic of variability in game patterns, MA studies have focused on differences between men and women (Costa, Afonso, Brant, & Mesquita, 2012; Lima, Palao, Moreira, & Clemente, 2019), different competitive levels (Méndez, Gonçalves, Santos, Ribeiro, & Travassos, 2019; Yi, Gómez, Liu, & Sampaio, 2019) and different player positional statuses (Clemente, Sarmiento, & Aquino, 2020; Gonçalves, Figueira, Maçãs, & Sampaio, 2014). What seems to be lacking is an exploration of variability in collective game patterns within the same competitive level, as well as intra-team variability in individual patterns for players of the same positional status.

The aim of this review was to explore how game patterns variability in team sports has been studied through MA. Specifically, it was intended to establish what categories of game patterns variability have been considered, and to organize them into a conceptual model with five dimensions.

METHODS

While systematic reviews comprehensively analyze the state of the art, we chose to perform a narrative review given the aims to conceptually analyze knowledge of game patterns variability in team sports and organize this knowledge in a unified conceptual framework. Narrative reviews are valid approaches for overviews of specific conceptual approaches to a theme (Sutton, Cherney, & White, 2021) and play an important role in providing readers with an up-to-date development of the literature on a specific topic (Rother, 2007). Narrative reviews are theoretically driven and are performed to provide a cohesive and organized perspective on a topic, often building useful conceptual models. Narrative reviews do not use the detailed methodological descriptions typical of systematic reviews (Bettany-Saltikov, 2010), focusing in presenting a conceptual map that helps organizing the different dimensions of knowledge under a coherent perspective.

Still, we established some criteria for the searches, which were conducted in September 2020 and updated in early May of 2021 using Web of Science, Scopus, PubMed and Scielo. Studies using MA were selected to represent the diversity of themes and team sports studied in the literature (e.g., inter-team variability due to gender; inter-team variability within the same competitive level). The title, abstract or keywords had to contain: (a) “variability” OR “variation” OR “dispersion” (b) AND “differences between male and female” OR “comparisons between male and female” OR “differences between men and women” OR “comparisons between men and women” OR “competitive level” OR “within level” OR “different players” OR “player position” OR “function” OR “within same player”; (c) AND “team sports” OR “sport*”. Selection of studies followed a criterion of diversity in terms of the dimensions of variability in game patterns being addressed (e.g., intra-team variability within the same positional status). This study was approved by the Ethics Committee of the Faculty of Sport of the University of Porto (09 2020 CEFADe).

DEVELOPMENT

Studies using MA to assess the game patterns variability in team sports provide valuable references for optimizing competitive performance and training processes, but focusing on average performances (Gryc, Zahalka, Maly, Mala, & Hrasky, 2015; Martens, Daly, Des-

champs, Staes, & Fernandes, 2016) conceals important inter- and intra-team differences. Some studies have suggested that each team’s game patterns deviate from average performances (Gryc et al., 2015; Rabinowitz & Arnett, 2013). We proposed a conceptual framework to categorize different types of game patterns variability in team sports (a) inter-team variability across sex/gender; (b) inter-team variability across competitive levels; (c) inter-team variability within the same competitive level; (d) inter- and intra-team variability due to positional status; and (e) intra-team variability within the same positional status (FIGURE 1).

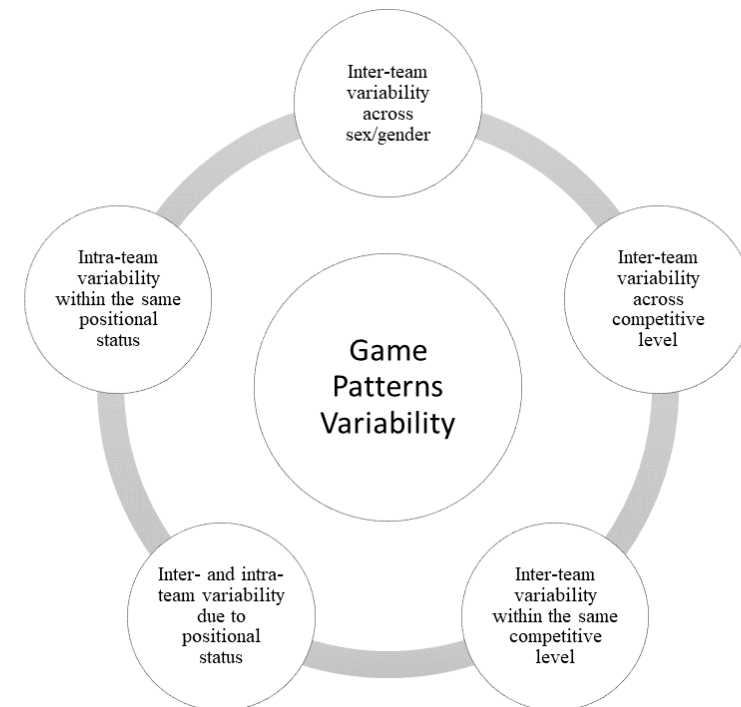


FIGURE 1. Proposed domains of game patterns variability.

MANIFESTATIONS OF VARIABILITY IN GAME PATTERNS

Inter-team variability based on sex/gender

This dimension captures variability in game patterns between men and women. Such differences have been analyzed in volleyball (Costa et al., 2012; Lima et al., 2019) and in rugby (Barkell, Connor, & Cotton, 2016), for example. A first study by Costa et al. (2012) analyzed differences between men’s and women’s volleyball in game patterns. Significant differences between the sexes were identified for three game actions: type of serve, tempo, and type of attack. Specifically, the velocity of the game for women’s was slower than for men’s, while men’s were more aggressive in serve and attack, resulting in a longer

transition in women youth volleyball and a predominance of side-out in men youth volleyball. A second volleyball study (Lima et al., 2019), which analyzed variability in intra-team approaches and patterns based on gender, found that men assumed higher risk in service and had higher attack efficacy than women, thus providing evidence of variability between the sexes. In this way, gender emerges as a relevant indicator for framing and interpreting performance, including game patterns.

A third study, by Barkell et al. (2017), aimed to test whether the game variables associated with winning in rugby were gender specific. Winning women's teams used more quick lineouts and had less ineffective lineouts than losing women's teams. Winning men's teams gained more set piece possession from scrums and used more uncontested restarts than losing men's teams. It is important to note that authors often publish separate articles for men and women, such as those of Laporta et al. (2018a, 2018b) on the relationships between game actions and how different game patterns flow emerge in high-level men's and women's volleyball, thus highlighting differences in the approach to inter-team variability based on sex. In such cases, the individual studies do not provide comparisons between men and women, but combining the different studies affords interesting comparative data on the game patterns variability, if the methods and the competitive levels were similar.

These three studies applied different methodological tools and procedures. Both volleyball studies (Costa et al., 2012; Lima et al., 2019) used the game analysis software '*Data Volley*' to collect and analyze data. Descriptive statistics were applied to characterize the occurrence of variables (frequencies and percentages), and multinomial logistic regression was then applied to test differences between genders. The study by Barkell et al. (2016) in rugby applied an original and research-specific instrument, created in Microsoft Excel®, to code game variables on a continuous scale according to the time sequence of actions. This allowed all game actions to be recorded, and comparisons to be made between genders (Kolmogorov-Smirnov test) and between winning and losing teams (Mann Whitney U test).

It is also worth highlighting some limitations of the above studies. First, in Costa et al. (2012) other variables should have been considered, such as the timing of the game, the quality of the opponents, and contextual variables. Second, the study of Barkell et al. (2016) only analyzed the quarter- and semi-finals of the competition, which was a limitation because a greater number of occurrences of the previous stages would give a better indication of the differences found between sexes. Finally, the study by Lima et al. (2019) was missing an offensive organizational analysis of the teams associated with the outcome of the game. The volleyball articles focused overly on complexes I (side-out) and II (transition), but the game has seven complexes (Martins, Afonso, Coutinho, Fernandes, & Mesquita, 2021) and so a large portion of these game complexes remains underexplored.

Inter-team variability due to competitive level

Different playing levels (e.g., Olympic vs. regional level, elite vs. sub-elite) are associated with different game patterns. In MA, these differences have been investigated in various modalities. In football, studies have explored how relational tasks and contextual variables influence the game actions and game pattern of teams from different leagues (Méndez et al., 2019; Yi et al., 2019). In volleyball (Ramos, Coutinho, Silva, Davids, & Mesquita, 2017b), studies have compared the influence of game variables on tactical behaviors in teams competing at elite (Olympic Games) and non-elite (Portuguese Championship) levels.

In football, Méndez et al. (2019) explored the power of task-related and contextual variables to establish differences between teams competing in three elite futsal leagues (Portugal, Spain, and Russia). The main findings of this study included: (1) that there were differences in attack and counterattack between Portuguese, Spanish and Russian teams; (2) that Portuguese and Russian teams used more positional attacks, and fewer counterattacks and set pieces, than Spanish teams; (3) that the same was not true in the analysis of winners and losers between leagues; and (4) the number of goals and the 5vs4+GK strategy were the most powerful variables for predicting winning teams in the three leagues. Recently, Yi et al. (2019) aimed to identify the relationship between game variables and team match performance. The main findings of this study were that most teams qualified for the knockout phase of the 2018 FIFA world cup appeared to have a more stable performance in terms of goals scored, attack and pass, while non-qualified teams showed a stable performance in terms of defense.

In volleyball, Ramos et al. (2017b) compared the influence of game status and final team ranking on the variability of tactical performance behaviors, in women's volleyball teams competing in the Olympic Games (elite level) and Portuguese League (national level). The main study findings were: (1) there were differences between the players and teams at different levels in terms of setting conditions; (2) there were small differences between teams at different levels in terms of attack tempo; (3) in the attack zone, the elite teams demonstrated a trivial effect; and (4) in block opposition, inter-team differences were moderate, with national players showing greater variability in the number of opponents used in the block.

In terms of methodology, the studies of Méndez et al. (2019) and Yi et al. (2019) used specific and credible MA tools for game analysis in their respective modalities. Méndez et al. used two tools: Instat® and Astrofutsal®. Because the platforms were different, the data were then exported and merged in Microsoft Excel® for analysis. In the study by Yi et al. (2019), OPTA software was used to extract important data to study variability in the group phase of the Champions League. Finally, Ramos et al. (2017a) used a specific and original tool for analysis, and later used Shannon entropy measures to evaluate the uncertainty of an informational variable and quantify its complexity.

In short, research indicates that there is variability emerging from the competitive level. Teams differ and across competitive levels, such as between international and national teams, in each stage of the game. For example, Portuguese and Russian teams use more positional attacks and fewer counterattacks than Spanish teams (Méndez et al., 2019). Moreover, qualified teams tend to perform more steadily (i.e., goals scored, attack and pass), while non-qualified teams tend to perform better defensively. It is worth noting some limitations with this body of work. Ramos et al. (2017a) and Méndez et al. (2019) highlighted a need for longitudinal studies, while Yi et al. (2019) argued that other situational and task variables needed to be considered to better characterize team performance. Differences between competitive levels should be considered for all game phases (e.g., transition and counterattack) and ages.

Inter-team variability within the same competitive level

Inter-team variability within the same competitive level reflects the extent to which teams of similar skill and performance differ in features and game patterns. There are numerous distinct ways to approach the game within championships where teams are of the same competitive level (Garganta, 2009), making it a distinct feature between teams. Such differentiation can derive from the characteristics and experience of individual players, and game model used (Garganta, 2009). For example, while the level of all teams in Basketball's NBA is similar, there are observable differences in game patterns and in the way that teams approach the game (Fewell, Armbruster, Ingraham, Petersen, & Waters, 2012).

To our knowledge, the only study that considered inter-team variability within the same competitive level was published by Castelão, Garganta, Afonso and Da Costa (2015) in football. The authors investigated differences in the offensive playing patterns of six national teams at the same competitive level (Italy, France, Greece, Portugal, Spain, and Germany) when competing in the 2006 FIFA World Cup and UEFA Euro 2004 and 2008. To encode the sequence of events in the game, the authors used an original and specific spreadsheet in Microsoft Excel®. Analyses were performed using two software for data analysis. The study found different standards for the offensive sequences of play across teams. For example, a primary characteristic of the Greek team was making short offensive actions with few passes between their players and seeking to finish quickly, which is consistent with an offensive counter-attacking game. In contrast, Italy presented short and inconclusive sequences, which characterizes a wide variability of offensive actions, thus hindering and/or making it impossible to define offensive game patterns for this team. Finally, a predominant characteristic of the Spanish team was longer offensive actions (e.g., passing the ball between players and waiting for the emergence of empty spaces and corridors, caused by the movements of opponents, before finalizing of the shot). A key limitation of this work was its lack of analysis of contextual variables in relation to the game marker and investigation of defensive aspects. More work is required in the dimension of inter-team variability within the same competitive level.

Inter- and intra-team variability due to positional status

Investigations of inter- and intra-team variability based on positional status address the variability in behavioral/functional performance between groups of players that differ in function or positions. Studies using MA have explored the various positional statuses within the football game (Gonçalves et al., 2014), the positional criteria of the players and their game actions (Clemente et al., 2020; Moura, Santana, Vieira, Santiago, & Cunha, 2015) and the tactical-technical performance of defenders and midfielders (Liu, Gómez, Gonçalves, & Sampaio, 2016). In the study of Gonçalves et al. (2014) patterns between defenders, midfielders and forwards were analyzed during an 11-a-side football game. Players (defense, midfielders, and forwards) were closer and more coordinated with their own specific centroid of position. This coupling effect was stronger in the midfielders and weaker in forwards, probably because midfielders control the center of the pitch where most game action occurs. In addition, the dynamic positioning of all players was more irregular for forwards because of their need to be less predictable when playing. A study by Moura et al. (2015) aimed to interpret the organization of football teams during competition via the positional variability of players, showing that lateral midfielders and lateral defenders had the greatest variability throughout the championship compared to other positions.

Recently, Liu et al. (2016) highlighted that the defenders (central and laterals) of strong football teams made more attacking and pass-related actions, and fewer actions and events related to defense, than their counterparts from weak teams. Central midfielders from strong teams made more passes and organizations related to actions (assist, touch of the ball, pass, pass accuracy, through the ball, successful dribbling), but fewer shots, than those from low-level teams. Forwards from strong teams were superior to those from weak teams in most attack-related actions (assists, shots on target, touches on the ball, pass passes, successful dribbles, and increased passing accuracy), probably due to the better teams' attacking opportunities. Recently, Clemente et al. (2020) focused on intra-team variability as a function of position in football. Inter-positional differences in the pass were identified, becoming a more targeted study on the performance variability of in the team's possession. Variability differed from position to position within the team. There were intra-team differences, primarily between positions, in the pass, both in the games won and lost. These findings indicate competitiveness between teams is directly linked to variability and in game actions.

Methodologically, three studies (Gonçalves et al., 2014; Liu et al., 2016; Moura et al., 2015) used GPS as a game analysis tool. This was used to extract important data for the study of variability, information related to centroids and the creation of interfaces, based on video and positioning of the player on the pitch. In Clemente et al. (2020), games were coded using an original tool created for the study, which was used to extract information via the adjacency matrix. Our analysis suggests that this dimension of variability has mos-

tly focused on effectiveness and physical parameters, with less attention given to game patterns. There is a need to consider the organization of opponents to provide a better understanding of positional variability between teams and opponents. Studies should also consider more specific moments of play or offensive process (e.g., direct attack, transitions, attacks with and without success).

Intra-team variability within the same positional status

Intra-team variability within a positional status refers to differences between players with the same position/function within a team. The work of Ribaupierre and Lecerf (2018) provided a broad perspective of how intra-team variability has been addressed theoretically and empirically. This domain of variability deserves attention because it plays an essential role in PA and MA, affording comparisons of patterns of play within a team, and particularly between players of the same position, to identify divergent models (e.g., existence of distinct patterns between the two lateral defenders in football, or between the middle-blocker net of three attackers or the net of two attackers in volleyball). Describing intra-team variability within the same position is fundamental for developing current understanding of player trends. Such knowledge will help make training tasks more representative of the real context and make the development of specific game positions more effective and efficient (Liu, Gómez, & Lago-Peñas, 2015). However, we were unable to identify any studies on intra-team variable within the same function.

CONCLUSIONS

We aimed to organize the dimensions of game patterns variability in team sports into a novel conceptual framework. The model considers five dimensions of game patterns variability: (a) inter-team variability based on sex/gender; (b) inter-team variability due to competitive level; (c) inter-team variability within the same competitive level; (d) inter- and intra-team variability due to positional status; and (e) intra-team variability within the same positional status. Relevant differences in game patterns exist between men and women in several sports, but direct comparisons are limited by the fact that most research tends to publish data for men and women in separate articles, although there are exceptions. Game patterns differ across competitive levels, but notably also within the same competitive level. Unsurprisingly, there is variability due to different positional status, but also within the same positional status. The overarching conclusions are: (a) variability in game patterns can be analysed under a minimum of five dimensions, which provide different, but complementary, information; and (b) monolithic performance models do not seem to apply – despite the constraints imposed by each sport, there is still space for respecting team and individual idiosyncrasies.

REFERENCES

- Barkell, J. F., Connor, D. O., & Cotton, W. G. (2016). Characteristics of winning men's and women's sevens rugby teams throughout the knockout cup stages of international tournaments. *International Journal of Performance Analysis in Sport*, *16*(2), 633-651. doi:10.1080/24748668.2016.11868914
- Bettany-Saltikov, J. (2010). Learning how to undertake a systematic review: Part 1. *Nursing Standard*, *24*(50), 47-55. doi:10.7748/ns2010.08.24.50.47.c7939
- Caballero, C., Davids, K., Heller, B., Wheat, J., & Moreno, F. J. (2019). Movement variability emerges in gait as adaptation to task constraints in dynamic environments. *Gait and Posture*, *70*, 1-5. doi:10.1016/j.gaitpost.2019.02.002
- Canossa, S., Abraldes, J. A., Estriga, L., Fernandes, R. J., & Garganta, J. (2020). Water polo shooting performance: Differences between world championship winning, drawing and losing teams. *Journal of Human Kinetics*, *72*(1), 203-214. doi:10.2478/hukin-2019-0107
- Castelão, D. P., Garganta, J., Afonso, J., & Da Costa, I. T. (2015). Análise sequencial de comportamentos ofensivos desempenhados por seleções nacionais de futebol de alto rendimento. *Revista Brasileira de Ciências do Esporte*, *37*(3), 230-236. doi:10.1016/j.rbce.2015.05.001
- Castellano, J., & Pic, M. (2019). Identification and preference of game styles in laliga associated with match outcomes. *International Journal of Environmental Research and Public Health*, *16*(5090). doi:10.3390/ijerph16245090
- Chryssanthopoulos, C., Ziaras, C., Zacharogiannis, E., Travlos, A. K., Paradisis, G. P., Lambropoulos, I., ... Maridaki, M. (2015). Variability of performance during a 60-min running race. *Journal of Sports Sciences*, *33*(19), 2051-2060. doi:10.1080/02640414.2015.1026379
- Clemente, F. M., Couceiro, M. S., Martins, F. M. L., Mendes, R. S., & Figueiredo, A. J. (2015). Soccer team's tactical behaviour: Measuring territorial domain. *Proceedings of the Institution of Mechanical Engineers, Part P: Journal of Sports Engineering and Technology*, *229*(1), 58-66. doi:10.1177/1754337114547064
- Clemente, F. M., Sarmiento, H., & Aquino, R. (2020). Player position relationships with centrality in the passing network of world cup soccer teams: Win/ loss match comparisons. *Chaos, Solitons and Fractals*, *133*. doi:10.1016/j.chaos.2020.109625
- Costa, G., Afonso, J., Brant, E., & Mesquita, I. (2012). Differences in game patterns between male and female youth volleyball. *Kinesiology*, *44*(1), 60-66. Disponível em <https://hrcak.srce.hr/file/124413>
- Davids, K., Araújo, D., Correia, V., & Vilar, L. (2013). How small-sided and conditioned games enhance acquisition of movement and decision-making skills. *Exercise and Sport Sciences Reviews*, *41*(3), 154-161. doi:10.1097/JES.0b013e318292f3ec
- Fewell, J. H., Armbruster, D., Ingraham, J., Petersen, A., & Waters, J. S. (2012). Basketball teams as strategic networks. *PLoS ONE*, *7*(11), e47445. doi:10.1371/journal.pone.0047445
- Gamaldo, A. A., An, Y., Allaire, J. C., Kitner-Triolo, M. H., & Zonderman, A. B. (2012). Variability in performance: Identifying early signs of future cognitive impairment. *Neuropsychology*, *26*(4), 534-540. doi:10.1037/a0028686
- Garganta, J. (2009). Trends of tactical performance analysis in team sports: Bridging the gap between research, training and competition. *Revista Portuguesa de Ciências do Desporto*, *9*(1), 81-89.
- Gonçalves, B. V., Figueira, B. E., Maças, V., & Sampaio, J. (2014). Effect of player position on movement behaviour, physical and physiological performances during an 11-a-side football game. *Journal of Sports Sciences*, *32*(2), 191-199. doi:10.1080/02640414.2013.816761
- Gregson, W., Drust, B., Atkinson, G., & Salvo, V. D. (2010). Match-to-match variability of high-speed activities in premier league soccer. *International Journal of Sports Medicine*, *31*(4), 237-242. doi:10.1055/s-0030-1247546
- Gryc, T., Zahalka, F., Maly, T., Mala, L., & Hrasky, P. (2015). Movement's analysis and weight transfer during the golf swing. *Journal of Physical Education and Sport*, *15*(4), 781-787. doi:10.7752/jpes.2015.04119
- Higham, D. G., Hopkins, W. G., Pyne, D. B., & Anson, J. M. (2014). Performance indicators related to points scoring and winning in international rugby sevens. *Journal of Sports Science and Medicine*, *13*(2), 358-364. Disponível em <http://www.ncbi.nlm.nih.gov/pmc/articles/pmc3990890/>

- Hurst, M., Loureiro, M., Valongo, B., Laporta, L., Nikolaidis, T. P., & Afonso, J. (2016). Systemic mapping of high-level women's volleyball using social network analysis: The case of serve (KO), side-out (KI), side-out transition (KII) and transition (KIII). *International Journal of Performance Analysis in Sport*, 16(2), 695-710. doi:10.1080/24748668.2016.11868917
- Inacio, E. C., Barbetta, P. A., & Dantas, M. A. R. (2017). A statistical analysis of the performance variability of read/write operations on parallel file systems. *Procedia Computer Science*, 108, 2393-2397. doi:10.1016/j.procs.2017.05.026
- Kempton, T., Sirotic, A. C., & Coutts, A. J. (2014). Between match variation in professional rugby league competition. *Journal of Science and Medicine in Sport*, 17(4), 404-407. doi:10.1016/j.jsams.2013.05.006
- Laporta, L., Afonso, J., & Mesquita, I. (2018a). Interaction network analysis of the six game complexes in high-level volleyball through the use of eigenvector centrality. *PLoS ONE*, 13(9), 1-14. doi:10.1371/journal.pone.0203348
- Laporta, L., Afonso, J., & Mesquita, I. (2018b). The need for weighting indirect connections between game variables: Social network analysis and eigenvector centrality applied to high-level men's volleyball. *International Journal of Performance Analysis in Sport*, 18(6), 1067-1077. doi:10.1080/24748668.2018.1553094
- Lima, R., Palao, J. M., Moreira, M., & Clemente, F. M. (2019). Variations of technical actions and efficacy of national teams' volleyball attackers according to their sex and playing positions. *International Journal of Performance Analysis in Sport*, 19(4), 491-502. doi:10.1080/24748668.2019.1625658
- Liu, H., Gómez, M. A., Gonçalves, B., & Sampaio, J. (2016). Technical performance and match-to-match variation in elite football teams. *Journal of Sports Sciences*, 34(6), 509-518. doi:10.1080/02640414.2015.1117121
- Liu, H., Gómez, M. A., & Lago-Peñas, C. (2015). Match performance profiles of goalkeepers of elite football teams. *International Journal of Sports Science and Coaching*, 10(4), 669-682. doi:10.1260/1747-9541.10.4.669
- Martens, J., Daly, D., Deschamps, K., Staes, F., & Fernandes, R. J. (2016). Inter-individual variability and pattern recognition of surface electromyography in front crawl swimming. *Journal of Electromyography and Kinesiology*, 31, 14-21. doi:10.1016/j.jelekin.2016.08.016
- Martins, J. B., Afonso, J., Coutinho, P., Fernandes, R., & Mesquita, I. (2021). The attack in volleyball from the perspective of social network analysis: Refining match analysis through interconnectivity and composite of variables. *Montenegrin Journal of Sports Science and Medicine*, 10(1), 45-54. doi:10.26773/mjssm.210307
- Méndez, C., Gonçalves, B., Santos, J., Ribeiro, J. N., & Travassos, B. (2019). Attacking profiles of the best ranked teams from elite futsal leagues. *Frontiers in Psychology*, 10(1370). doi:10.3389/fpsyg.2019.01370
- Moura, F. A., Santana, J. E., Vieira, N. A., Santiago, P. R. P., & Cunha, S. A. (2015). Analysis of soccer players' positional variability during the 2012 UEFA european championship: A case study. *Journal of Human Kinetics*, 47(1), 225-236. doi:10.1515/hukin-2015-0078
- Nia, M. E., & Ali Besharat, M. (2010). Comparison of athletes' personality characteristics in individual and team sports. *Procedia - Social and Behavioral Sciences*, 5, 808-812. doi:10.1016/j.sbspro.2010.07.189
- Pyne, D. B., Trewin, C. B., & Hopkins, W. G. (2004). Progression and variability of competitive performance of Olympic swimmers. *Journal of Sports Sciences*, 22(7), 613-620. doi:10.1080/02640410310001655822
- Rabinowitz, A. R., & Arnett, P. A. (2013). Intraindividual cognitive variability before and after sports-related concussion. *Neuropsychology*, 27(4), 481-490. doi:10.1037/a0033023
- Ramos, A., Coutinho, P., Silva, P., Davids, K., Guimarães, E., & Mesquita, I. (2017a). Entropy measures reveal collective tactical behaviours in volleyball teams: How variability and regularity in game actions influence competitive rankings and match status. *International Journal of Performance Analysis in Sport*, 17(6), 848-862. doi:10.1080/24748668.2017.1405611
- Ramos, A., Coutinho, P., Silva, P., Davids, K., & Mesquita, I. (2017b). How players exploit variability and regularity of game actions in female volleyball teams. *European Journal of Sport Science*, 17(4), 473-481. doi:10.1080/17461391.2016.1271459
- Ribaupierre, A., & Lecerf, T. (2018). On the importance of intraindividual variability in cognitive development. *Journal of Intelligence*, 6(2), 17. doi:10.3390/jintelligence6020017
- Rother, E. T. (2007). Systematic literature review X narrative review. *Acta Paulista de Enfermagem*, 20(2), v-vi. <https://doi.org/10.1590/s0103-21002007000200001>
- Schorer, J., Baker, J., Fath, F., & Jaitner, T. (2007). Identification of interindividual and intraindividual movement patterns in handball players of varying expertise levels. *Journal of Motor Behavior*, 39(5), 409-421. doi:10.3200/JMBR.39.5.409-422
- Silva, P., Esteves, P., Correia, V., Davids, K., Araújo, D., & Garganta, J. (2015). Effects of manipulations of player numbers vs. field dimensions on inter-individual coordination during small-sided games in youth football. *International Journal of Performance Analysis in Sport*, 15(2), 641-659. doi:10.1080/24748668.2015.11868821
- Sutton, A., Chorney, A., & White, R. (2014). *Crime prevention: Principles, perspectives and practices* (2nd ed.). Port Melbourne, VIC, Australia: Cambridge University Press.
- Yi, Q., Gómez, M. Á., Liu, H., & Sampaio, J. (2019). Variation of match statistics and football teams' match performance in the group stage of the UEFA champions league from 2010 to 2017. *Kinesiology*, 51(2), 170-181. doi:10.26582/k.51.2.4