Goal Events in Football:

An investigation into how football performance is impacted in a given time-period preceding a goal event

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ABSTRACT

Football has evolved into a fast-paced, time-constrained sport. Over the last two decades match analysis has become a useful tool to utilize objective information that can subsequently improve performance. Defined as the ball successfully crossing the goal line, goal events are the ultimate objective of the sport. Goal events are arguably fundamental to a team's success in football, thereby understanding the physical and technical performance in periods preceding these moments can play a pivotal role in obtaining consistency. The present study aimed to identify key aspects of football performance that may predict goal outcomes. Physical and technical performance data were collected from one professional team in their opening ten matches of their 2021/22 season. Performance indicators were analysed across offensive (goal-scoring) and defensive (goal-conceding) outcomes, as well as playing position. The data collected in the full-match, as well as the 5-minutes preceding a goal event were analysed statistically. Passing frequency, penalty area entries and shooting accuracy were most prominent in goal-scoring ($p<0.05$) whilst passing accuracy, crossing accuracy, sprint count and tackling success were seen to be pertinent to goal-conceding ($p<0.05$). The present study also confirmed significant differences for scored and conceded goals in relation to positional physical performance. A team's ability to keep custody of the ball whilst penetrating the opposing teams most vulnerable areas of the pitch was found to relate to goal-conceding and goal-scoring, respectively. Across playing position given goal events seemed to be a consequence of differing match demands. The key performance indicators explored in this investigation highlighted what most often contributes to positive and negative match events, instead of simply what implicates winning and losing.

1.1 - INTRODUCTION

Performance analysis in sport has gained considerable attention throughout the 21st century and has been accepted as a valuable tool for understanding and enhancing athletic performance. Earliest implementations of performance analysis involved the systematic collection, interpretation, and evaluation of data to enhance understanding of individual and team performance (Hughes and Franks, 2004). The work of Carling and colleagues (2009) further emphasised the importance of performance analysis in identifying trends, patterns, and trajectories of critical moments within a match or competition. Such research ultimately enables coaches, analysts as well as athletes themselves to make informed decisions and optimize training programmes.

Soccer, most commonly referred to as football, is the most popular sport in the world. More than 240 million people across the globe play soccer regularly according to the Federation Internationale de Football Association (FIFA), with over 2 billion people spectating each year. The popularity of football and the lucrative nature of this professional sport has driven the need to utilise evidence for decision making, to ensure key outcomes and targets are achieved (O'Donoghue, 2009). In football, obviously a goal event in the ultimate objective of the game and argued to be the most significant moment of a match due to its direct impact it has on a match's outcome (Martin, 2016). Researchers have examined various aspects related to goal events, including goal-scoring patterns, goal-scoring techniques and the tactics implemented from the outset of a match (Hughes et al., 2013).

This work has employed tools such as video analysis, GPS tracking systems as well as statistical modelling to provide a comprehensive framework for studying the complex dynamics of sport to improve athlete outcomes. It has become accepted within the literature that utilizing data driven techniques and cutting-edge technologies best delves into the intricacies of sport performance, where the insight gained from this drive's performance improvements (Hughes and Franks, 2004; O'Donoghue, 2009; McGarry et al., 2009; Russel, Rees, and Kingsley, 2013). More recently, a study by McGuckin et al. (2020) and Hughes and Franks (2019) investigated the role performance analysis plays in elite football and deemed it crucial for providing objective feedback, informing training intervention and facilitating match strategies. This work drives the notion that performance analysis in football is a multi-faceted, it goes beyond observation, and can provide detailed information for coaches.

Over the last two decades, work designed to enhance outcomes has focussed upon tactical principles and comparisons between physical and technical requirements of the sport on both players and teams (Gonzalez-Villora et al., 2015). Tactical parameters refer to the strategic aspects of match, such as formations (Bradley et al., 2011), player position (Tierney et al., 2013), team coordination (Modric et al., 2019) whilst technical aspects denote to the individual skills and techniques employed by the team, such as passing accuracy (Redwood-Brown, 2008), ball control and shooting proficiency (Russel, Rees, and Kingsley, 2013). Indicators from analysing physical parameters tend to have been focused upon understanding an athlete or teams' endurance levels and physiological capabilities to optimize training programmes and minimize the risk of injury (Mohr et al., 2012). The importance of monitoring player workload is recognised by physiotherapists and fitness coaches as a tool to design optimal training and recovery strategies (Mernagh et al., 2021).

As established by the literature, the physical demands and tactical strategy are interlinked, and factors such as player positions (Abbott et al., 2017; Asian Clemente et al., 2019), formations of the team (Rampinini et al., 2007) as well as the shape and quality of the opposition (Bradley et al., 2011) can alter the player demands and the pattern of data collected.

Although current work has substantially improved understanding in this field there are still substantial gaps in knowledge, evidence, and data across many offensive and defensive aspects of the game. What appears remarkable is that currently there is no work in football focussing upon patterns of play in the period leading to the important goal scoring events. Anecdotally, commentary and speculation often refer to observation and comment such as 'the goal was coming' or a 'shift in dominance' in a period of game play leading to a goal. Television analysis now regularly incorporates presentations of 'possession in the past 5 minutes' on screen. However, despite this insight, there is very little objective data across key metrics in periods leading to the scoring or conceding a goal.

The present investigation has the aim of reviewing data from game play, to ascertain if there are trends of note across goal events (both offensively and defensively) that can add to the understanding of these key moments in game play. This work could potentially help teams optimize strategies, and ultimately review if this information could be used to support decision making in football.

1.2 - LITERATURE REVIEW

Performance Analysis in Football

Match analysis is commonly used in many sports and is viewed as a process of collecting and utilizing objective information to provide feedback on performance (Carling, Williams, and Reilly, 2007). Such a process helps to identify strengths and weaknesses of a given team, opponents and in some cases individuals (Carling et al., 2008) in an effort to limit mistakes, and build-on advantages to attain consistency in performance and maintain successful outcomes.

Performance analysis is concerned with the examination and improvement of sport performance. Practitioners make extensive use of video-based technology (Groom and Cushion, 2004; Liebermann et al., 2002) and wearable electronic devices (Modric et al., 2019, Schulze et al., 2021) to directly provide and access performance analytic data. Performance analysis is now strongly associated as a critical part of the coaching process (Carling, Williams, and Reilly, 2007; Lyle, 2002; Stratton, Reilly, Williams, and Richardson, 2004; Groom, Cushion and Nelson, 2011. A coach's dependence on subjective intuition, gut, and memory to improve their teams have been replaced at the higher echelons of the game by teams of analysts. Seminal research completed by Franks and Miller (1991) found that only 50% of critical factors in a football match could be remembered by coaches, and latter research in the same field concluded by Laird and Waters (2008) saw a pool of qualified coaches only recall 59% of the critical events within a single half of a match. Performance analysis not only provides a quantitative element that helps to overcome qualitative limitations (Asian Clemente et al., 2019) to help afford a better understanding of performance (O'Donoghue, 2009), but also helps to prevent the loss of information not recalled by the coach. Therefore, with this there has been a significant increase in the volume of performance analysis research.

A performance indicator is a selection, or combination, of action variables that aims to define some, or all aspects of a performance (Hughes and Bartlett, 2002). In order to be successful, these performance indicators should relate to, and have a key impact upon performance or outcome (Lees, 2002). Performance indicators can capture both global and partial aspects of a team's physical or technical performance during matches and competition (McGarry, O'Donoghue and Sampaio, 2015). Mackenzie and Cushion (2013) described sporting performance as multifaceted, complex, time-constrained, and largely unpredictable. Football meets such descriptions, whereby behaviours will not always be consistent, meaning performance indicators are most influenced by player-opponent interactions (Tenga, Holme, Ronglan and Bahr et al., 2010a; McGarry, 2009). In football, scoring goals is the ultimate determinant of success and has received considerable attention in performance analysis. Goals are not only a discriminatory factor of outcome, but also an indicator that offers a competitive advantage to teams of more success (Kapidžić et al., 2010). However, it is credible to introduce the argument of conceding goals and the importance of defending in football, whereby limiting the chances opponents have can prompt just as much success for teams performing at every level of competition.

The use and selection of given performance indicators has been related to modelling sporting performance (Garganta, 2009; Sarmento et al., 2018), to better understand the difference between successful and unsuccessful outcomes, as well as winning and losing teams (Andrzejewski et al., 2017, Vaz et al., 2019; Gomez-Piqueras et al., 2019). Fernandez-Navaro and colleagues (2016) highlighted the importance of studying physical, technical, and tactical performance indicators in order to objectively analyse a team's performance. Findings from research completed in the last decade normally permit that more successful teams record better, and are stronger in offensive parameter values, whilst losing teams display higher averages in defensive variables, i.e., more crosses conceded and more fouls being committed (Castellano et al., 2012; Lago-Peñas, Lago-Ballesteros and Rey, 2011; Lago-Ballesteros et al., 2010). Throughout the available literature, technical-tactical indicators of shots on target, successful passes as well as possession have been strongly associated with winning (Liu et al., 2016; Mao et al., 2016). Shooting as a performance indicator seems to discriminate successful teams; Ensum and Colleagues (2005) found that more affluent teams had a greater number of shots, shots on target as well as higher rates of shots per goal, this is further supported by Harrop and Nevill (2014). Several authors have shown that shooting within this area of the pitch prompts the greatest pertinence to goal-scoring. Wright et al. (2011), Acar et al. (2009) and Yiannakos and Armatas (2006) found that 79%, 77% and 79.6% of goals scored in the English Premier League, World Cup and European Championships, with Plummer (2013) finding 81.2% of goals come from within the 18-yard box in general. Furthermore, authors have also found that possession within the 18-yard box are thought to be correlated with scoring opportunities, and that shots from inside the penalty area are known to have higher levels scoring efficacy due to a player's ability to place shots further from the goalkeepers reach (Michailidis et al., 2004) making it much more efficient when comparing it to shots taken outside of the penalty area (Tenga et al., 2010b; Filetti et al., 2017).

Passing is a key component in regard to the efficiency of an attack as it directly relates to the creation of space and goal-scoring opportunities (Jankovic et al., 2011). Early research into this aspect of performance found differences between winning and losing teams regarding passes (Grant, Williams, and Reilly, 1999). Hook and Hughes (2001) observed that successful teams had greater all possession via producing more successful passes in Euro 2000, however there were no significant differences in the number of passes that led to goals. More recently, Tenga et al. (2010b) suggested that longer passing sequences were more effective offensively compared to smaller passages of play, but it must be noted that this is dependent on a team's ability to sustain such passing lengths in the systems the coach's set-up (Tenga and Sigmundstad, 2011). Within the last decade, significant differences have been identified in the number of passes performed, and the percentage of successful passes completed in relation to outcome, whereby more passes create more goal-scoring opportunities (r=0.47, p0.032) (Delgado-Bordonau et al., 2013). This suggests that teams who lead back off and absorb pressure, solidifying that losing teams need more possession of the ball to craft goal-scoring opportunities to secure and equalizer. In terms of evaluating the effectiveness of a team in football, passing accuracy and the conversion of passing into shots-on-goal are critical indicators of effective ball possession and possession quality (Kempe et al., 2014). Teams who are successfully offensive use a wider variety of passes as a tool to create shooting opportunities (Hughes and Franks, 2005). Penetrative, forward passes have been seen to increase the number of entries into an opponent's 18-

yard box and in turn the number of shots taken at goal (Filetti et al., 2017). Furthermore, Collet (2013) highlighted significant relationships between passing, shooting and overall team success in domestic leagues, yet demonstrated that efficiency and precision mattered; unproductive and superfluous passes are key predictors of worse team outcomes across football, whereby increased levels of passing accuracy enables longer passing sequences to be sustained by teams. In turn custody of the ball is retained demonstrating how coaches can utilise such aspects of performance to facilitate their teams in becoming less predictable when attacking (Hughes and Franks, 2005). Alternatively, a team's ability to retain custody of the ball, and produce more successful passes can be used as a defensive strategy. Jones, James and Mellalieu (2004) stated that by maintaining possession of the ball via enhanced passing accuracy outputs helps teams reduce opportunities for opponents to successfully intercept and generate counterattacks.

Armatas and Colleagues (2009) suggested that the majority of goals during the 2002/03 champions league resulted from pressing the opposition into more advanced areas of the pitch, accommodating more favourable situations via attacking in numbers (i.e., 3vs2, 2v1 situations). Wright et al. (2011) further stated teams should apply pressure within the defensive third of the opponent's half in order to force turnovers of possession in more advanced areas of the pitch. Acar et al. (2009) and Kirkendall, Dowd and DiCicco (2002) found 88% and 83% of goals scored originated from within the final third of the pitch, respectively. Tenga and colleagues (2010a) also demonstrated that attacks originating in the final third created more goal-scoring opportunities, once more highlighting the importance of utilising possession in the final third and attacking against a disrupted and disorganised defensive line to formulate more goal-scoring opportunities. Ball possession where fewer defenders are in between the penalty area and the ball have been defined as counterattacks, have the most successful outcomes (Saramento et al., 2018). More recently, research has confirmed that attacks which lead to a scored goal are most often a result of disruptions being caused in the opponent's defensive line (Schulze et al., 2019). Early research completed by Armatas et al. (2005) demonstrated that a higher percentage of goals in the 2002-2004 Champions League competition resulted from counterattacks (16.9%) with only 11.1% of goals deriving from organised attacks. Although it may be deemed as an effective attacking strategy, Yiannakos and Armatas (2006) found that counterattacks occurred less frequently when compared to organised attacks and set pieces (20.3%, 44.1% and 35.6%, respectively). However, the higher the ball is won up the pitch, the more disorganised the defence will be, making it harder for the opposition to recover their line, exploiting space as a result (Delgado-Bordonau et al., 2013). This becomes an aspect of attacking systems to consider, due to its relation to faster, shorter passing sequences, success rate and playing style.

Although it is worthwhile understanding what influences the effectiveness of a team in creating and converting their shooting attempts or goal-scoring opportunities, there is good reason for an equal emphasis on underpinning factors as to why goals are conceded. Such information can help enhance match preparation and increase the team's chances of successfully defending their own goal (Kempe et al., 2014). Successful teams rely on combining goal efficacy, achievement, and consistency with the ability to accept fewer goals from its opponents. Research regarding defensive statistical indicator analysis has shown that better teams display more organised and structured defensive behaviour, managing to significantly limit the opposition's attempts at goal (Evangelos et al., 2013). From this same study, Evangelos and colleagues (2013) identified that the number of crosses conceded is a key indicator of defensive superiority, as it recognises the team's ability to reduce the number of passes the opposition makes into the penalty area, heightening the chance of averting goals and conceding them. Further, when teams gain possession of the ball through no direct fault of the opposition (i.e., via winning 50/50 tackles, Aerial Duels) it has been seen to lead to 39% of attacks at goal (Wright et al., 2011). The heightens the importance of transitions in play, whereby winning more ground and aerial duels can help put the ball into more advanced areas of the pitch or settle to a better positioned team-mate who Is already in space. Studies have also found that indicators of defensive efficacy stem from interceptions, winning 50/50 challenges and aerial duels, as these are most pertinent to match outcome and averting goals from being conceded (Taylor et al., 2008). It has also been found that defensively, the number of fouls committed are related to losing teams (Lago-Peñas, Lago-Ballesteros and Rey., 2011). This variable is important as teams who commit more fouls prove opponents with more set-pieces (i.e., Free-Kicks) which opens up for more goal-scoring opportunities, entries into the penalty area and even more direct shots-at-goal in some scenarios for the opposing teams. The current knowledge provides strong argument for further investigations into the effect of an improved defensive performance.

Positions, Formations and Strategy

Traditionally, a football team consists of 11 players. The players on the field are allocated to certain position, these sub-groups being defenders (wide defenders and central defenders). Midfielders (central midfielders, attacking midfielders, defensive midfielders, and wide midfielders), Forwards (wingers, centre forwards) and a Goalkeeper. Across the literature, it is as well accepted fact that it is the performance of these footballers that have a direct influence on a match's final result (Abbott, Brickley and Smeeton, 2018; Leontijević et al., 2019). An understanding of these positions is vital as each undertake their own roles and responsibilities every match which are dependent on the team's formation, style of play and opponent. Each position often has differing physical demands (Bloomfield et al., 2007), which are influenced by the tactics implemented by managers before the match starts.

Defenders play directly Infront of the goalkeeper. Orejan (2011) simply described the primary role of this position is to prevent the opposition from scoring, using defensive methods to delay attackers from penetrating scoring territories (i.e., the 18-yard box). Central defenders (CB) make up the crux of a team's back-line, whilst the number of wide defenders, commonly known as full-backs (FB) is dependent on the formation being played. This line often includes four defenders (2 CB's and 2 FB's) but other shapes require just three centre-backs, favouring more offensively-minded wing-backs (i.e., 3-5-2, 3-4-3 shapes). Midfielders occupy the most central areas of the pitch, and often take up the role of both assisting in team attacks and aiding the defence when other players are drawn out of position or under pressure. Most traditional formations see the midfield be taken up by two central midfielders (CM), but modern-day variations have seen pivots of three (two CM's, and one central defensive (CDM) or central attacking (CAM) midfielder) or 4 (two wide midfielders a CDM and CAM) of the equivalents (Borghi et al., 2021). The midfielders lie in-between the forwards and defenders and have the responsibility of providing balance to the side, ensuring defensive and offensive lines move up-and-down the pitch smoothly. Attackers, otherwise known as forwards or strikers, have the important role of scoring goals and creating goal-scoring opportunities. As always, depending on the teams desired formation determines how many forwards take up the pitch. Generally, teams play with one, two, and sometimes even three forwards, and in the case of the latter, two players line-up closer to the side-line and are referred to as wingers. These players are expected to make runs out wide and deliver more crosses to penetrate the opponent's penalty area, whilst central attackers often make runs in-between and behind the opposing defensive line in the hope of taking on more shots at the opponent's goalkeeper (Wright et al., 2011).

Modric and colleagues (2019) saw game performance variables as almost position specific. Central defenders most often contest in aerial and 50/50 duels to win back custody of the ball for the team. Full backs are likely to complete more crosses and passes into the wider areas of the pitch. Although full backs are defensive players, who have a starting tactical line-up in the defensive third of the pitch, they are expected to make several entries into the final third via overlapping wingers to maximise forward passing options and press the opposition higher up the pitch, all of which aids the team in entering the opposition penalty area (Yi et al., 2018). Midfielders are responsible in maintaining possession of the ball in the most heavily populated areas of the pitch (centrally), as well as distributing it to better positioned teammates. This playmaking role can help to expose space ahead of the midfield third, and key passes, especially in a forward direction, are key in enabling forwards to have shots at goal (Bradley et al., 2011). Wide Forwards (wingers) aid attacks by completing dribbles, pressing-high and moving into space to receive passes during counterattacks. Their activity is focused on attacking and operating in the final third. The more of these attacking actions said players can perform in said areas of the pitch increases the likelihood of creating shooting opportunities and breaking down defensive lines (Dellal et al., 2011). Therefore, a central forwards role of finishing puts a greater focus on shooting and dribbling performance indicators, of which have the greatest link to positive match outcomes.

Research completed by Bradley and Colleagues (2010) suggested that central midfielders, full-backs, and attackers cover the most distance at high-intensity (i.e., sprinting), with wingers covering the most distance at very-high intensity. Authors agree that distances covered at greater intensities are the most valid measures of physical performance in football, due to its strong relationship with training status and resistance to fatigue (Krustrup et al., 2003; 2005). Therefore, it seems that players in these given areas of the pitch undertake the greatest physical demands. This is further supported by more recent research completed by Borghi et al. (2021), who found full-backs and wingers cover the greatest distance in most playing formations (10.3±61.2km and 10.2±27.5km, respectively), most often at high speeds via repeatedly sprinting and accelerating up and down the pitch, whilst strikers perform the greatest number of sprints. Such analysis of positional data through the years has put an increased emphasis on the relationship there is between player position and training status. Research now aims to stratify data positionally to aid conditioning coaches understanding of specific physical demands for each position. For instance, for forwards it is fundamental they have high levels of speed and power to beat their opponent, complete more dribbles and outwit the goalkeeper in order to score more goals (Bradley et al., 2013). From such, performance can be improved by matching these demands in training, in the hope of enabling players to become better adapted to their position physically, in turn enabling them to perform their roles and responsibilities with more consistency, pertinently and quality.

Research has well documented that variations in performance are also a consequence of different playing formations (Di Salvo et al., 2009; Krustrup et al., 2006; Drust et al., 2007). Playing formations dictate distances covered by teams; well set-up teams will make it more difficult for opponents to move the ball and create space (Schulze et al., 2021) whereas expansive, wide systems will enable more players to move into space created ahead of them both on and off the ball (Carling, 2011). Defensive systems, such as 4-5-1, have been argued to place the greatest physical demands on attackers as they are surrounded by a greater number of defenders (Bauer, 1993). The greater reinforcement of midfield zones in this system leaves the lone attacker isolated (Bangsbo and Peitersen, 2000), increasing the difficulty of making runs off the ball and retaining possession when receiving passes. Team formations, and positional responsibilities have evolved over time (Bradley et al., 2011), and will continue to do so in order for teams to continue to take advantage of an opponent's shape and style of play. For instance, Reilly, Drust and Clarke (2008) analysed physical performance in 4-3-3 systems whilst Bradley and Colleagues (2010) did the same in 4-4-2 shapes. Research has demonstrated that high-intensity running is a discriminating factor between differing playing formations (Rampinini et al., 2008). These authors mentioned high intensity running actions often reflect the characteristics of playing formation, which prompts as a good tool for optimal training preparation, enabling to adapt training specifically to the formation employed by managers so players are better suited to the physical demands of a given formation. Formations most commonly adopted by the team analysed in the present investigation were 4-3-3 and 4-4-2 shapes. These can be considered the shapes most commonly used in modern football, however also the most physically demanding (Modric et al., 2019). Bradley et al. (2011) found that attackers, midfielders, and defenders covered more distance at high intensity in possession of the ball when compared to more defensive equivalents (i.e., 4-5-1). 4-3-3 formations are favoured by coaches who seek to dominate the ball whereby Its attacking set-up is most associated with positional play due to greater occupation of the midfield and offensive zones (3 midfielders, 3 attackers). Research has identified that more high intensity runs/accelerations are performed by attackers in a 4-3-3 system (Bradley et al., 2011). Such supports the idea that in 4-3-3 shapes players are more active in their running behaviour, where such positional rotations enable runs into space (i.e., wingers tuck inside) and more pertinent entries into the opposition's penalty areas and defensive thirds (i.e., full-back overlaps) when in possession of the ball, whilst also providing efficient changes into more defensive shapes when possession of the ball is lost (i.e., 4-3-3 to 4-5-1). Furthermore, attackers achieving a higher metabolic load distance, as observed by Tierney and Colleagues (2016) in 4-3-3 shapes supports the idea that teams can gain from numerical advantages in attack from three forwards instead of two (i.e., 4-2-2 systems), only adding to the pressure that is put on the opponent's defensive line (Mohr, Krustrup and Bangsbo, 2003), opening greater opportunity to create goal-scoring opportunities.

Contrastingly, some coaches favour an extra player in midfield instead of three forwards to obtain a solid shape that is difficult to break down, covers pockets of space and protects the most dangerous areas of the pitch (i.e., Penalty Area). As a 4-4-2 shape can offer a greater emphasis on discipline and organisation when out of possession, it provides an explanation as to why attackers have been found to cover less distance at high-intensity in 4-4-2 systems when compared to 4-3-3 equivalents, yet defenders in the former shape cover the most distance at high-intensity (Bradley et al., 2011). The investigation completed by Tierney et al. (2016) found that total distance covered by teams in a 4-4-2 formation was significantly lower when compared to other equivalents, such as 4-2-3-1 and 3-5-1. This is likely a result of a 4-4-2's flat set-up (Hughes and Franks, 2005), whereby a lack of dynamism can often see teams in this shape become outnumbered in the midfield areas of the pitch, making it harder for players to maintain custody of the ball, offload to better positioned teammates and increase the pace of the game. In systems such as 4-4-2, a strength lies in width by utilising both wide midfielders and wide defenders in the same formation. Di Salvo et al. (2007) found that defenders and midfielders in wide positions (known as full-backs and wide midfielders) perform more high-intensity actions and cover greater distances in high-speed running when compared to central equivalents. For teams playing in a 4-4-2 such actions can permit greater opportunities whilst attacking and defending, whereby getting the ball wide can see more crosses be performed into the opposition penalty area by wide midfielders and full-backs (Lago, 2009), as well as tracking back down the outside lines of the pitch when possession is eventually lost, in an effort to regain the ball in more advanced areas of the pitch to face up to a more disorganised defence (Wright et al., 2011).

Minimal differences have been observed for technical performance indicators when investigating differences between playing formations. Bradley and Colleagues (2011) further found no statistically significant differences in ball possession between formations, but rather in passing. More passes were seen to be performed in a 4-4-2 shape compared to a 4-3-3 and 4-5-1 alternative, with defenders performing a higher percentage of successful passes in the former, however these tend to result in more lateral passes (Zhou et al., 2021). This again links to the more offensive set-up of a 4-3-3, and defensive equivalent in a 4-4-2. The greater technical requirements of the defenders here see as to why they are limited to lateral passing options, where it is much harder to break the lines and pressure the opposition centrally. This again shows the greater fluidity 4-3-3 shapes provide in and out of possession enables more positions to perform more high intensity running, as players have more freedom to move and rotate to always provide a simple passing option; helping retain custody of the ball.

Physical Parameters – Application, Validity and Reliability of Methods

Laboratory and field testing has been widely used to achieve a deeper insight into football performance (Rienzi et al., 2000; Duthie et al., 2005; Bangsbo et al., 2006; Le Gall et al., 2010; Mernagh et al., 2021) where more recently the technical and tactical nature of the sport has shown the physical characteristics to be multifactorial, continually adapting to the game's evolution (Bradley et al., 2013; Barnes et al., 2014; Malone et al., 2015). The combination of locomotor activities with sport specific actions, such as tackling, changes in direction and dribbling, constitute to the total physical load a player experiences during training and matches (Dalen et al., 2016; Mallo and Navarro, 2008; Bucheit et al., 2014). Numerous studies have investigated several physical aspects of soccer using computer-assisted motion analysis (Bangsbo, Mohr and Krustrup, 2006; Rampinini et al., 2007) and advanced our understanding of position-specific work-rate profiles as well as the physical demands put upon players (Randers et al., 2010). However, the alternative in global positioning systems (GPS) has become a preference over computer assisted technology (Dalen et al., 2016). GPS has been acquired by coaches, practitioners, and analysts to gain accurate and precise measures on an athlete's movement patterns (Kelly et al., 2014), physical demands (Coutts and Duffield, 2010) and running performance (Modric et al., 2019) at different intensities and speeds. Furthermore, GPS technology has been used and applied to a wealth of public health issues, including mobility and physical activity patterns across various age groups (Sanchez et al., 2017; Tandon et al., 2018; Mennis et al., 2018) and from such their ever-improving precision, accuracy, usability and more importantly safeness sees GPS devices become an important make-up of analysis in sports such as football (Modric et al., 2019; Canton et al., 2019, Sampaio and Maçãs et al., 2012).

GPS technology has been credited to be highly applicable in the evaluation of physical activity in sporting performances (Sanchez et al., 2017). Their prevalence in competitive sport in the modern day is down to their developments in safety, availability, accuracy, and precision (Canton et al., 2019; Sampaio and Maçãs, 2012). Globally, FIFA amended their rules for the use and wearability of global positioning system units during competitive matches (FIFA, 2015). In the United Kingdom, since the start of the 2015-16 completive season in England, teams were given permission to allow their players to wear such direct worn GPS devices (FA, 2015). Such rules now allow the quantification of player movements, loads and energy costs (Nevill, Holder and Watts, 2009). Akenhead and colleagues (2013) found that out-field players cover approximately 9-12km at a mean intensity of approximately 80-90% maximal heart rate. This GPS data provides more accurate context for earlier findings that found players perform at 70% $VO_{2\ max}$ (Di Salvo et al., 2007; Mohr Krustrup and Bangsbo, 2005). Ultimately, data obtained by GPS devices provides detailed information that coaches to interpret to best tailor player-specific periodized training programs (Willmont*,* 2016) which aids injury prevention, player welfare and future performances (MacLeod, Morris, Nevill and Sunderland, 2009). These devices too offer the advantage of live/real-time feedback (Scott et al., 2015), which coaches can use to analyse specific game demands and individual performances, to ensure the 11 players out on the field are meeting match demands.

Football/Soccer is an intermittent sport by nature, characterized by periods of low-intensity running quickly followed by high-intensity bursts of locomotion (Du Pont et al., 2004; Young et al. 2018). Research has shown that players conduct 1000 to 1400 short time actions throughout a match with frequent changes in direction every 4-6 seconds and high-intensity actions every 70 seconds (Stolen et al., 2005). Research completed in this fields' infancy saw authors agree that the components of fitness power and speed are critical to decisive situations in football, and differentiate successful and unsuccessful players (Cometti et al., 2001; Meyer, 2006; Reilly, Bangsbo and Franks, 2000; Wragg, Maxwell and Doust, 2000). Di salvo and colleagues (2009) strongly believed that overall tactical and technical effectiveness was more important than any physical capability of a team. Yet in recent years this opinion seems to have shifted, where success isn't just achieved from technical-tactical efficacy. More recent work has demonstrated that a greater emphasis must be put on physical performance in order to prevent injury, better shape training programmes and develop player fitness (Schulze et al., 2021). High-intensity actions for instance that are performed in soccer matches has been related closely to match outcome (Aquino et al., 2017; Chmura et al., 2017; Zhou et al., 2018). Rein and Memmert (2016) emphasised the importance of conceptual connections between technical-tactical and physical performance indicators in underpinning success. There is no doubt that examining both technical and physical performance would help teams create better player profiles, whereby drawing comparisons between the two will aid physical trainers, coaches, and analysts in enhancing performances (Yang et al., 2018).

As a result of unpredictable movement patterns, expectations of players to perform maximal or near-maximal sprints in varying distances (Aziz et al., 2008) interspersed with recovery periods of differing durations, it is no surprise that several studies have shown a decrement in physical performance during football matches. Particularly, high-intensity activity has been seen to decrease in the second half (Mohr, Krustrup and Bangsbo, 2003), where such decline in physical work has been related to acute physical fatigue (Bangsbo, Mohr and Krustrup, 2006; Mohr, Krustrup and Bangsbo, 2005). Andrzejewski and colleagues (2009) sought that the intensity of the effort and the distance covered by players drops by 5-10% in the second half (First Half = 5.1±101km, Second Half = 4.5±132km). Depletions in the number of sprints performed and the total distance covered by outfield players is best explained by a decrease of glycogen in muscle fibre (Krustrup et al., 2006; Akenhead et al., 2013; Vigh-Larsen et al., 2018). Continually, evidence from time-motion analysis studies investigating high-intensity efforts showed that the percentage of time spent performing high-intensity actions is lower throughout the second half when compared to the first half equivalent (Carling and Dupont, 2011). This has been argued by Di Salvo and colleagues (2009) who found that at high-intensity thresholds (19.1-23km/h) outfield players there were no significant differences ($p>0.05$) between outputs in the first and second halves of a match (304±251m and 301±255m, respectively). Although this aspect of physical performance is not considered in the present investigation, it is good information to be aware of, as it is plausible that physical outputs for certain outcomes may be underpinned by differences between halves. Such may explain to conditioning coaches and medical cohorts that training status must be improved in order to maintain levels of high-intensity work throughout the match for the team to have more possession of the ball via mirroring levels that were achieved in the first 45-minutes of the fixture (Redwood-Brown et al., 2012).

The activity profiles of outfield players are position dependant, a critical reason as to why running at different intensities differ between individuals (Dwyer and Gabbett, 2012). A player's tactical roles and available space afforded to them in a given match is what truly influences the distances they cover and at what intensity (Dalen et al., 2016). It's well established that football is characterized by low- (i.e., walking) and high-intensity (i.e., sprinting) activities (Bloomfield et al., 2007; Ingebrigtsen et al., 2012; Krustrup et al., 2009). Research suggests that distances covered at high intensities are more valid measures of physical performance in soccer because of its strong association with a player's training status (Krustrup et al., 2003; 2005). Likewise, Cometti and colleagues (2001) concluded that short sprinting is an important determinant of match winning actions (i.e., late runs into the penalty area, creating/exploiting space, being first to a loose ball). More recent applications of this research however have argued that straight sprinting is the most frequent action in goal situations. Faude, Koch and Meyer (2012) found that 67% of goal situations came from a player making a straightforward sprint without ball possession. Although this research contests upon direction, findings still highlight how a player's ability to accelerate and reach maximal speeds more quickly is an essential component of game-deciding moments in football (Bradley et al., 2010). Therefore, quantifying acceleration and maximal running speeds in selected periods of match play may help to underpin reasons for fatigue, injury and in some cases, goals.

Running thresholds have been routinely acknowledged by Carling et al., (2008) as well as Di Salvo et al. (2009). Said authors classified thresholds for each locomotor movement action:

- **Walking** - Speeds under 2m.s (>7.2km/h)
- **Jogging** - Speeds between 2-4m.s (<7.2km/h - >14.4km/h)
- **Running** – Speeds between 4-5.5m.s (<14.4km/h - >19.8km/h)
- **High-Speed Running** – Speeds between 5.5-7m.s (<19.8km/h – >25.2km/h)
- **Sprinting** – Speeds in excess of 7m.s (<25.2km/h)

These same thresholds have been utilised in research completed in the last decade (Faude et al., 2012; Modric et al., 2019; Schulze et al., 2021).

Breaking total distance covered into differing intensities provides a holistic overview of running performance in football. Yang and colleagues (2018) found that more successful teams cover greater distances whilst sprinting and at high intensity. Such results promote the importance of sprinting in generating space, allowing penetrative passes In and behind the oppositions defensive line and completing more dribbles one-on-one situations (Gomez et al., 2012). Although high-intensity movement patterns, like accelerations and sprints, are more energetically demanding (Osgnach et al., 2010), these mentioned aspects of physical performance seem to hold a higher level of importance when compared to other intensities footballers perform at throughout a match. This is plausible because alterations in running behaviour (i.e., changes in speed and direction) disturbs the balance between and within the opponent's defensive line (Schulze et al., 2019) and that such movement patterns precede a goal more often (Schulze et al., 2021). Rampinini et al. (2007) further showed that performing at high-intensity and performing more accelerations in and out of possession can lead to improved technical ability during matches. With this being said, it makes it clear that associations and relationships can be drawn between both physical (i.e., total distance covered, high-intensity running, accelerations) and technical-tactical (i.e., shots, crosses, challenges, dribbles) parameters, and how the combination of both are correlated with match outcome (Modric et al., 2019).

The importance of collecting and analysing movement demand data of team sport athletes during both training and matchday sessions has been well established in the literature (Coutts and Duffield, 2010; Di Salvo et al., 2007; Sirotic et al., 2009; Johnston et al., 2014). Such evaluation of specific physical performance indicators better guides conditioning coaches and sport scientists to positional, individual and team demands involved during match play as well as in differing formations (Modric et al., 2019). Rampinini and colleagues (2009) believe that movement demands, such as total distance covered and distances covered at high speeds have a definite relationship to the match performance of an individual, with Johnston et al. (2012) further relating this to team performance. Several studies have been completed specifically to collect data about players' running performance. Recently, Aquino and Colleagues (2017) observed match running performance in Brazilian professional football players and indicated correlations between these data and winning teams, home advantage. Several authors agree that global positioning systems and directly worn electronic devices have reported stronger coefficient of variation (CV) compared to time-motion, video, and hand notational tracking systems (12% and 25%, respectively), making the former display higher levels of reliability and validity (Randers et al., 2010, Akenhead et al., 2013; Austin and Kelly, 2014). The validity of GPS units is necessary to reflect how precisely the device measures the intended distance and, or speed (Johnston et al., 2014; Scott et al., 2016). This is vital for sports application to athletes during training and competition, and reporting key results to coaches, managers, and practitioners. In the early 2010's, there was limited investigations into the validity and reliability of both 10Hz and 15Hz GPS units (Coutts and Duffield et al., 2010). Throughout this decade, 10hz, 15Hz and even 1-5Hz global positioning units have been more thoroughly explored in the literature, testing for their validity, repeatability as well as their interunit reliability (Akenhead et al., 2013; Varley, Fairweather and Aughey, 2012). It is well accepted that linear distance running tests over short distances (i.e., 15-30m) using 10Hz GPS units reports low levels of mean level of error and strong interunit reliability (5.5±1.2%) (Castellano et al., 2011) but this margin of error often increases as distances are increased, changes of direction are introduced, and more efforts are performed at high-intensity (10.2±27%) (Jennings et al., 2010). Johnston and Colleagues (2014) found that both 10Hz and 15Hz GPS units had good levels of repeatability when measuring total distance covered, and when examining peak speed, the 10Hz unites interunit reliability was a startling improvement on previous findings from 1Hz and 5Hz units (Barbero-Álvarez et al., 2010; Johnston et al., 2012). Perhaps more importantly the validity results for distance covered and time spent at both low and high-speed running intensities had moderate to good levels of error, and 10Hz units displayed the lowest levels of error for all movement demands compared to 1Hz, 5Hz and 15hz equivalents. The validity of measuring such movements has been challenged as often where the speed of movement increases so does the coefficient of variation. Johnston and colleagues (2014) found that the percentage typical error of measurement at running speeds between 14-19km/h was 7.6%, rising to 12.1% upon maximal efforts (>19km/h) in 10-15Hz GPS units. Vickery and colleagues (2014) too supported this notion, as inter-unit reliability was poor for two change of direction courses (17.2% and 22.8% CV, respectively). Extensive research conducted by Scott et al. (2016) found the 10Hz units as the optimal GPS tracking device, with no additional benefit of utilizing a same speed of 15Hz. The difference seemed that athletes who wear the same device whenever possible across their tracking sessions, the stronger the inter- and intra-unit reliability became, reporting the coefficient of error at high-speed to be no higher than 5%.

Results of recent validity and reliability research suggests that 10Hz GPS units provide a more reliable measure of movement demands than rivalled 15Hz devices. However, differences between global positioning systems occur at higher speed zones (Johnston et al., 2014). At speeds in excess of 19.8-20km.h, interunit reliability for all types of GPS units falls, as reported by several authors (Jennings et al., 2010; Johnston et al., 2012; Petersen et al., 2009). When analysing movement data in said speed zones, caution is required as GPS units records such information with less accuracy and precision. Of course, limitations will always remain with all global positioning systems, and regardless of sampling frequency devices become less accurate as the speed of an athlete increases, most notably over shorter distances (Coutts et al., 2009; Duffield et al., 2010; Vickery et al., 2014). Based on the work of Johnston et al. (2014), the present investigation utilised a 10Hz system during all outdoor training and matchday sessions, a small-scale validity testing was run on the GPS devices prior to their use and incorporation during data collection, to ensure they are accurate enough for the given requirements of data reporting.

Ball-In-Play and Time-Frame Justifications

In order to quantify match demands in soccer, it is important to identify the most appropriate methods of analysis (Whitehead, Till, Weaving and Jones., 2018). Many game interruptions occur within a match of football, such as referees blowing the whistle for infringements, injuries, and the periods in which the ball is out of play (Siegle and Lames, 2012). Previous research has identified that an average of 54 to 57 minutes of a 90-minute match has the ball in play, as observed by Lagos-Peñas and colleagues (2012) in Europe's top leagues (Ligue 1 and German Bundesliga). This equates to about 62% of the time the ball is in play, yet in the ten years since this article it is now deemed to be lower than this figure in the Premier League, the English topflight level, where the ball-in-play in matches in the 2021/22 season averaged to be 56.3% of the total time (Hopkins, 2022). It is definitely then somewhat plausible to assume that in the lower tiers of English football this figure is somewhat, if not drastically, lower. Researchers suggest that a player's match-play demands which include ball-out-of-play periods underestimate the actual intensities of movements and activities made by football players (Wass et al., 2020). Ball-in-play cycles, most pertinently in the periods leading up to critical events such as goals, are considered the most appropriate and representative methods of analysing the most demanding passages of match-play in team sports (Riboli, Coatella and Espositio, 2020; Young et al., 2019). There is no doubt that the total distance covered in possession, and the tactical behaviours players make off the ball are some of the main figureheads for success in football performance (Hoppe et al., 2015; Moniz et al., 2020), therefore a greater focus on ball-in-play periods preceding a goal is maybe of greater interest to practitioners. Such focused analysis and findings can help aid in the prescription of sport-specific training drills that improve offensive and defensive play, as well as providing a comprehensive understanding of physical outputs and areas of such that can develop physical performance.

Authors have had much deliberation in regard to the optimum methods of quantifying match demands, and in which timescale. Carling and colleagues (2005) suggested that changes in player behaviours, team possessions and individual actions can be more closely identified in 5 to 15-minute periods. In challenge to this however, such a method is only said to account for broad fluctuations in intensity, disregarding periods of reduced intensity that occurs when the ball is out of play. This has been more recently investigated in rugby (Read et al., 2018). Contrastingly for instance, Schulze et al. (2021) investigated an array of physical indicators in the lead up to goal-scoring opportunities in the 1 and 5-minutes prior to an attempt on goal. Their justification for shorter timeframes was that larger windows, such as the 5-minute period, was also selected to account for at least one or more changes in possession, yet still relate to the overall physical output of the time-frame – whilst a 1-minute timeframe captured high-intensity actions as close to the attempt as possible (Scott et al., 2016). It seems using 5-minute time-periods as a snapshot rather than a rolling average is more effective, as Lago-Peñas, Rey and Lago-Ballesteros (2012) strongly believed that 5-minute rolling averages underestimate physical demands of play as at elite level major European championships the ball is only in play for an average of 54-56minutes.

In the present investigation, the 5-minute period analysed before a goal is scored or conceded was attributed for the time in which the ball was in play, excluding any data when the game was stopped for infringements, substitutions, medical intervention, and moments the ball exited the field of play. Quantifying match demands and activity profiles with a focus on periods in which the ball is in play is said to provide a better representation of player behaviours and match demands (Riboli, Espositio and Coratella, 2021, Wass et al., 2020, Young et al., 2019). Mernagh and colleagues (2021) defined the period in which the ball is in play as the duration of which the ball ongoing before the ball exits the pitch or the referee stops play. As for the present study, goals that were scored from a set-piece (i.e., free-kick or penalty) were excluded, a focus was purely put on goals scored from open-play. Therefore, making consideration and analysis of these parameters for when the ball was in play aims to provide a better representation of key actions and elements that lead to goals being scored and conceded.

Playing surface

Throughout the history of the football, there have been several different surfaces that have been used as a platform to host the sport. A substitute for a normal pitch that is played on grass is that of artificial pitches, made up of synthetic fibres that resemble natural grass. Artificial pitches first landed in England in the early 1980’s, with QPR’s Loftus Road, Luton Town’s Kenilworth Road, Oldham Athletics’ Boundary Park and Preston North-End’s Deepdale all installing artificial pitches. In their infancy, such plastic pitches were seen to be rugged and undulating, forcing the football to take unpredictable bounces and cause players to lose footing as a result of the turf. In turn, the FA banned such pitches in 1988. The rule still stands in the English Football League (EFL), as they state no matches should be played on artificial surfaces, ensuring member clubs remove artificial surfaces and install grass equivalents if one isn’t already. The Conference Leagues (The National League, National League South, and National League North), divisions below the professional body EFL, allow synthetic 3G pitches to be played on for all matches in the league if a given team already accommodates one (FIFA, 2015). Artificial surfaces pose many advantages to football clubs in regard to adverse weather, wear, and durability, as well as costs. Grass surfaces can only be played on for 4-5 hours a week, whereas artificial equivalents can be played on for around 50 (Hopkins, 2021). With such, clubs save costs that would otherwise be put towards upkeep and maintenance. Synthetic grass is far more durable, and less affected by extreme weather that would otherwise call games off (i.e., Waterlogged pitches). Clubs in Wales and Scotland for instance take advantage of such alternatives as a solution, likewise in Russia and Sweden artificial grass helps overcome the issue of frozen and frosted grass.

Although the available literature and research into artificial pitches is scarce and now very dated, initial findings saw that possible performance advantages can be attained on synthetic pitches, most notably home teams. Barnett and Hilditch (1993) analysed the effect of artificial pitches due to a commission of enquiry from the English Football League (EFL, 1989) for a recommendation on whether artificial pitches should be further restricted. Key findings included an excess of home points for teams who played on artificial pitches when compared to teams who played on natural grass. Teams who played on synthetic pitches compared to teams who played on natural grass saw 66.1% and 62.6% points scored in home matches, respectively – this was also in agreement with results from Baker (1989).

Furthermore, home teams on artificial grass saw a 57.7%-win percentage compared to the 47.7% of teams playing on natural pitches, suggesting that artificial pitches have a marked excess of wins. Such statistically significant findings also confirmed a home advantage for teams with home artificial pitches, as 0.28 points were gained for each home match, equating to 5-6 points a season (Barnett and Hilditch, 1993).

Although these studies indicate statistically significant and modest advantages of home performance on artificial pitches, caution must be taken when interpreting results due to the limited sample size, the lack of information on differences in performance throughout the match and no acknowledgement of results week-by-week. Although this data solidifies the EFL's stance on artificial pitches, it can also be discussed that the evolution of football and athlete training status over the last 30 years has developed players for all pitches and conditions – making performance equal on both natural and synthetic fields of play.

1.3 - PURPOSE

The purpose of the present thesis is to identify key aspects of football performance that may predict goal outcomes: specifically in the time-period leading up to a goal being scored or conceded. The research aims to build upon existing knowledge concerning the impact goals have on team performance and enhance understanding of if patterns in performance can distinguish both successful and unsuccessful outcomes. This then may be useful for coaches to facilitate match preparation; training focuses and specificity. Researchers believe that key performance indicators help to make sense of technical, tactical, and physical decisions made by players during matches. There is a lack of this type of investigation into football performance in critical time periods preceding a goal event. Interestingly, it may be that this period captures the moments of the gameplay that can significantly influence match outcome. Understanding the patterns and behaviours exhibited during these crucial moments can potentially provide valuable insight into team dynamics, tactical decisions, and individual player performance. This research aims to establish key performance indicators that contribute to goal-scoring opportunities and defensive vulnerabilities in the 5-minutes before a goal event, not just in the allocated 90-minutes. Studying the period prior to a goal allows for focused analysis of the immediate build-up, highlighting the interconnectedness of actions and decisions that lead to scoring opportunities or defensive breakdowns.

The incorporation and analysis of global positioning systems (GPS) data from each performance aims to broaden variables to a more relative level, specific to given positions and formations, in an attempt to underpin goal outcomes in real-time for coaches. Physiological parameters provide additional information as to the reasons of the match's outcome. The analysis of such features in a given time-period leading up to a goal being scored or conceded adds to the originality of research, helping to further identify trends in performance at a physical level that can maximise goal-scoring opportunities and minimise mistakes that can lead goals being conceded. The selected parameters used for this research will be analysed descriptively across outcome (win, loss, and draw) and statistically in the 5-minute time period leading up to a goal being scored or conceded. It is thereby hypothesised that given key performance indicators will differ between outcome at a descriptive level and have statistical significance in regard to the time leading up to the event of goals.

Significance of Studies:

It is a well-accepted fact that outscoring opponents is the primary goal in football. Authors stress the importance of understanding the preceding physical and technical performance in relation to optimising goal-scoring opportunities (Wright et al., 2011; Castellano et al., 2012; Pratas, Vollosovitch and Carita, 2018). Research has shown that goals impact player work-rate, motivational drive, and physical behaviours (Carling et al., 2005) and perform a higher percentage of successful passes, shots on goal, completed dribbles and tackles won – all of which increase a teams expected goal average and diminish the chances of goals being conceded (Lago-Peñas et al., 2010). Such information is utilised to optimise a coach's ability to facilitate goal-scoring and limit mistakes from being repeated in performance and obtain a level of consistency.

Castellano et al. (2012) ultimately found that situational variables (i.e., tackles won, fouls committed), ball possession and effectiveness of attacking play discriminate winning, losing and drawing teams from one another. Within the last decade, it has been believed that factors associated with transfers in play have increased the importance on tracking goals and goal-scoring opportunities back to their origin (Wright et al., 2011). The present investigation seeks to further our understanding on these said elements of the sport, however a greater emphasis is put upon the time leading up to goals being scored or conceded. Previous investigations of score-line effects in football have looked at the periods in which a team is winning, losing, or drawing, but more specifically in the 5-minutes leading up to a goal being scored (Redwood-Brown, 2008; Schulze et al., 2021). Performance indicators such as passing, passing accuracy, total and high-intensity distance covered, and maximal running velocity have been analysed in this time-interval within the mentioned studies. The 5-minute time-period is justified for use as it most certainly contains a change in ball-possession, and still relates to the physical output and the end of the timeframe (Bradley et al., 2013; Fransson et al., 2017; Schulze et al., 2019), all whilst identifying high-intensity actions as close to the attempt as possible.

Ultimately an understanding of key performance indicators that can enable attacks to be created more often, and goals be generated from such as a result, all whilst identifying aspects that indicate defensive superiority, stability and discipline that prevent goals from being conceded all aid analysis, coaches and managers in guiding training, tactics, and in-match decisions to be facilitated in more scientific attempt in obtaining successful outcome.

2 - METHOD

2.1 - Sample

One team competing in The Vanarama National League South 2021/22 season was analysed for the present study. To the best of the authors knowledge this is the first study investigating football performance at sub-elite levels of competition. Ten matches the studied team played were analysed in the opening fixtures of a new season to avoid implications of chronic fatigue on outcomes (Mohr, Krustrup and Bangsbo, 2005). Matches were captured using a camera match analysis system (SPIIDEO, Version 1.88.2, Malmö, Sweden). Within the sample of ten matches five were played at home and five were away fixtures. Goals for and against scored from open-play were included, with the exception of those deriving from set-pieces and dead ball situations which were excluded to further strengthen the analysis of actions whilst the ball was in play. An equal number of matches out of the total sample were played on traditional grass (5) and an artificial pitch (5).

Only players who completed 90-minutes were analysed in this study, excluding data outputs from substitutes, whereby a total of twenty players met this specification across the analysed fixtures. This sample consisted of four central defenders, three wide defenders, six midfielders and seven forwards – the sociodemographic and anthropometric data of these observed players can be seen below in Table 1. This investigation was approved by the Faculty Ethic board of Canterbury Christ Church University. Participants were given full details of the study procedures and provided written consent to participate.

	Age (Years) Mean±SD	***Body Mass (Kg) Mean±SD***	***Height (Cm) Mean±SD***
Total Sample (n=20)	26.5±4.4	85.5±8.9	180.3±4.0
Central Defenders(n=4)	27.5±7.1	91.8±4.8	183.3±3.3
Wide Defenders (n=3)	26.0±4.5	89.7±12.3	182.7±3.8
Midfielders (n=6)	25.0±3.4	83.5±6.5	178.3±2.5
Forwards (n=7)	26.4±2.4	80.4±6.4	179.6±4.3

Table 1 - Sociodemographic and anthropometric characteristics of the studied players with differences among playing positions

2.2 - Variables

A total of 32 performance indicators were selected and calculated (18 related to attacking, 13 related to defending). These football specific technical performance indicators are those that where the majority have been previously investigated by the previous literature. The attacking and defensive performance indicators descriptions and operational definitions are below. For better contextualisation of some performance indicators, the pitch was divided into three spaces vertically split across the pitch, known as the Defensive, Midfield and Offensive thirds **(**see below)**.**

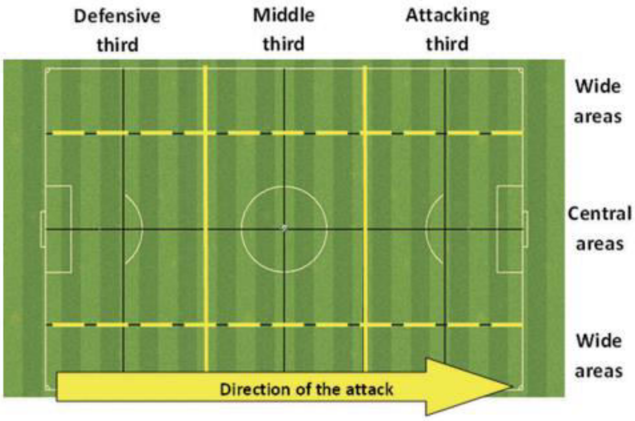


Figure 1: Pitch Divisions, with each of the thirds parallel to the goal-lines (From Fernandez-Navarro et al., 2016)

Passing direction was also considered to measure certain performance indicators, and these were categorised in relation to the diagram (**see below).**

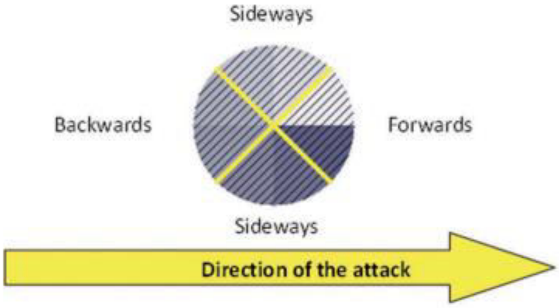


Figure 2: Pass direction classifications (From Fernandez-Navarro et al., 2016)

Technical KPI Descriptions

Pass – Ball played to a team-mate within four touches (Passes made back to the goalkeeper and goal kicks were excluded in the present investigation).
Opponent Pass - Ball played by the opposition team within four touches (Passes made back to the goalkeeper and goal kicks were excluded in the present investigation).
Forward (FWD) Pass – passes made by a player towards an opponent's goal.
Backward (BWD) and Lateral (LAT) Passes – pass made by a player towards their own goal, or sideways.
Total Shots – The number of shots taken at goal.
Total Shots Opponent – The number of shots taken at goal by the opposing team.
Shot On Target – result of a shot that forced a save, interception of block where its path was within the goal frame.

Shot on Target Opponent - result of a shot from an opposing player that forced a save, interception of block where its path was within the goal frame.
Shot Off Target – result of a shot that that caused the ball to exit the field, whereby its path was outside of the goal frame.
Shot inside the Penalty Area – number of shots taken inside 18-yard box.
Entry into Penalty Area For - an attack that led to a pass, cross, through ball or dribble into the opponents 18-yard box that was successful controlled by a teammate (excluded any scenarios where the ball was just played into and landed in the 18-yard box).
Entry into Penalty Area Against - an attack made by the opposing team that led to a pass, cross, through ball or dribble into the studied teams 18-yard box that was successfully controlled by a teammate (excluded any scenarios where the ball was just played into and landed in the 18-yard box).
Free Kick For – a set-piece opportunity that occurred in the offensive third of the pitch (Free-Kicks in the defensive and midfield thirds were excluded).
Free Kick Against - a set-piece opportunity that occurred in the opposing teams offensive third equivalent of the pitch (Free-Kicks in the defensive and midfield thirds were excluded).
Corner For – Set-Piece opportunity from a corner for studied team.
Corner Against – Set-Piece opportunity from a corner for the opposing team.

Technical KPI's - Operational Definitions

Successful Pass - a ball played to a teammate which was successfully controlled and kept in play.
Successful FWD Pass – a ball played to a teammate towards the opponent's goal which was successful controlled and kept in play.
Successful BWD/LAT Pass - a ball played to a teammate towards the studied team's own goal which was successfully controlled and kept in play.

Percentage of Successful Passes – the percentage of passes that were successfully completed.
Percentage of Successful FWD Passes - the percentage of passes played towards the opponent's goal that were successfully completed.
Percentage of Successful BWD/LAT Passes – the percentage of passes played towards the studied teams' own goal that were successfully completed.
Percentage of FWD Passes – the percentage of passes from the overall number of passes that were played towards the opponent's goal.
Percentage of BWD Passes – the percentage of passes from the overall number of passes that were played towards the studied team's own goal.

Situational Variables (Technical KPI's) Description

Cross For – number of crosses made by the studied team in the offensive third of the pitch, played into the opponents 18-yard box.
Cross Against – Number of crosses made by the opposing team in their offensive third equivalent into the studied teams 18-yard box.
Dribble – Recorded when a player of the studied team took five or more touches

Tackle – a 50/50 challenge where both a player of the studied team and an opponent were going for the same loose, unpossessed ball.
Aerial Dual - a 50/50 aerial challenge where both a player of the studied team and an opponent jumped for the same ball in the air.

Situational Variables (Technical KPI's) – Operational Definitions

Successful Crosses – a cross that reached a teammate and the ball was controlled successfully, or a shot was taken as a result.
Dribble Completed – where the dribble was successfully taken past an opponent with 5 or more touches.
Tackle Won – Possession and custody of the ball regained from winning the 50/50 challenge.
Aerial Duel Won - Possession and custody of the ball was regained from winning the ball in the air, with the studied team's player being the first to make contact and keeping the ball in play.

Percentage of Successful Crosses – The percentage of crosses that were successful.
Percentage of Dribbles completed – The percentage of dribbles that were completed.
Percentage of Tackles Won – The percentage of tackles won.
Percentage of Aerial Duels Won – The percentage of aerial duels won.

Physical Performance Indicators

The speed thresholds most commonly accepted are discussed in the literature review. The physical parameters selected for the present investigation are defined below:

Total Distance Covered (Km/m) - the total amount of distance players/teams complete in a match of given period of a match.
Distance (Meters) Per Minute – the average amount of meters covered per minute by a player or team in a match or given match period, otherwise attributed to work-rate.
Sprint Total Distance (m) – the total amount of distance players/teams complete in a match or given period of a match at speed in excess of 7m/s (<25.2km/h)
Distance covered at high-intensity (m) – the total amount of distance players/teams complete in a match or given period of a match at speeds between 5.5-7m/s (<19.8km/h-25.2km/h).
Sprint Count (n) – the number of sprints performed by a player or team in a match or given period of a match, quantified as a movement at a speed in excess of 7m/s (<25.2km/h) for a duration of 1.5 seconds or longer.
Accelerations (n) – a movement of 2m.s or above maintained for a duration of at least a second and a half (Dalen et al., 2016).

<u>2.3 - Procedures</u>

The variables analysed in the present study were two sets of football performance indicators (physical parameters and technical parameters) which were collected and stratified across match outcome (win, loss, and draw) and analysed in the 5-minutes preceding a scored/conceded goal. The data collected in regard to match outcome wasn't included in the statistical analysis. Instead, these descriptive statistics were used to make comparisons between the existing literature and current findings, helping to further identify key performance indicators that have an influence on a fixtures result. Therefore, to align with the studies purpose, exploring these performance indicators beyond outcome hoped to underpin what may or may not contribute to goal events in football matches.

The 5-minutes preceding outputs were compared against the full match data to assess any differences between the two. Data on physical performance indicators were collected by GPS technology (TITAN 2, TITAN Sensor, Houston, Texas) using a high-resolution sampling frequency of 10Hz as well as a 1KHz accelerometer. Such devices at this sampling frequency have been deemed reliable and valid in quantifying sport specific movements (Castellano et al., 2011) often having less than 1% measurement error (Johnston et al., 2014; Cummins et al., 2014). All players were assigned their own individual GPS unit prior to the commencement of the investigation. All devices were switched on 10 minutes prior to matches to attain a strong satellite signal as per TITAN instructions. Once the devices had been turned on, they were inserted manually between the players shoulder blades in a polyester and elastane harness which the players were provided and instructed to wear underneath their normal matchday kit. The GPS sensors were inserted with the flashing light facing away from the player backs to ensure maximum efficiency of the device.

The matches captured on the SPIIDEO enabled discrete events and performance indicators to be coded individually in each of the matches to provide full-match outputs. For the 5-minute time-period, the video was used to calculate the 5-minutes preceding a scored or conceded a goal where the ball was in-play. To further strengthen the inter-reliability of the analysis of this variable match-by-match technical indicators were coded again, whereby the frequency of indicators in this given period provided the 5-minutes preceding outputs. Throughout this investigation the performance indicators were tagged strictly in accordance with their above definitions. The same was also completed for each of the physical parameters via session explorer software on TITAN. The full-match data and 5-minutes preceding data was exported from their relevant software's into a Microsoft Excel data base for subsequent data analysis.

2.4 - Statistical Analysis

Statistical analysis was completed for 15 performance indicators (3 Physical, 12 Technical). Sprint Count, Sprint Total Distance, High-Intensity Distance Covered and Total Distance was also analysed in relation to each of the 4 positional variables. In Microsoft Excel the 5-minute and full-match absolute performance indicators were standardised into 'per-minute' values. Full-match data was divided by ninety (90-minutes) and goal-preceding data was divided by five (5-minutes), to report 'per minute' in the analysis. This was not required for percentage performance indicators. The full-match and 5-minute averages for all performance indicators were formulated in graphs to visualise differences between these two independent variables. This same process was also completed for the analysis of four positional groups (Forwards, Midfielders, Wide Defenders and Central Defenders). For the purpose of this investigation each positional group was allocated relevant physical performance indicators which were informed from the available literature and in turn selected for statistical analysis.

The data was transferred to IBM SPSS Statistics V.27 for MAC (SPSS, Chicago, IL), all statistical analysis were conducted using this software. Binary coding was used to compare the performance indicators in matches that were won and lost, and also for matches where goals were scored and those that were conceded. The statistical analysis was split into three phases, where first descriptive statistics were calculated on each variable, then the Shapiro-Wilk was utilised to assess normality. Independent samples t-tests were used where data was deemed to be parametric. The Mann Whitney-U test was conducted where parametric assumptions were not met. The tests were used to compare differences in three levels (goal scored vs. goal conceded, goal scored vs. full-match and goal-conceded vs. full-match).

Finally, Receiver-Operator Characteristic (ROC) curve analysis was used in the present study to explore predictive modelling in football, and the possibility of estimating expected outcomes and to what thresholds for given parameters and positions. The statistical significance for all analyses was set to P<0.05. Descriptive statistics for all variables are presented as means and standard deviations (Mean±SD), unless otherwise stated.

3 - RESULTS

3.1 – Sample

Ten matches were analysed for the present investigation, this sample included three wins, three draws, four defeats. In these three matches fourteen goals were scored and twelve were conceded, with five home matches and five away fixtures recorded.

3.2 – Absolute Parameters

In Appendix A tables 2.1 – 2.8 present the descriptive statistics in each of the parameters explored in the present investigation. All SPSS outputs can be viewed in Appendix C.

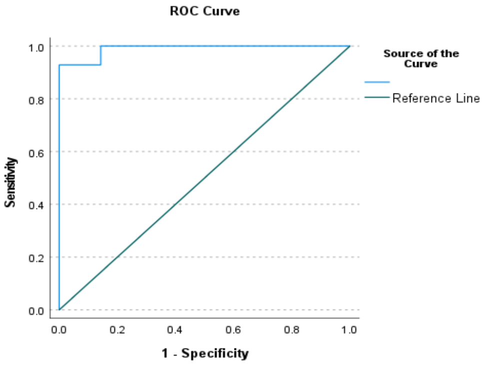
Absolute Parameters Mean±SD – Matches Goal Scored				
Parameter	**Full-Match Mean±SD**	**5-Mins Mean±SD**	**Full-Match Minutes Mean±SD**	**5-Mins Minutes Mean±SD**
FWD Passes (n)	**118±14.4**	**15±4.8**	**1.3±0.2**	**3.1±1.0***
Passes (n)	**202±45.3**	**25±8.7**	**1.5±0.5**	**4.9±1.7***
Entries into Box For (n)	**32±6.2**	**4±2.0**	**0.224±0.03**	**0.843±0.4***
Entries into Box Opp. (n)	**25±5.7**	**2±2.1**	**0.279±0.06**	**0.457±0.42**
High-Intensity Distance (m)	**1300.1±241.3m**	**65.7±17.5m**	**12.3±3.5m**	**13.1±3.5m**
Sprint Total Distance (m)	**940.4±180.8m**	**50.5±13.9m**	**8.8±1.3m**	**10.1±2.8m**
Sprint Count (n)	**377.5±43.4**	**24.7±7.9**	**4.2±0.5**	**4.9±1.6**

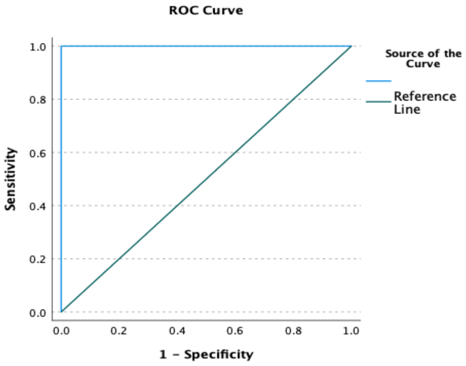
Table 2.9 – *Above is the Mean±SD outputs for the selected absolute parameters. These are show as outputs for the full 90-minute match, as well as the outputs scaled per minute in the 5-minute period leading up to a goal being scored for the selected absolute parameters. Statistically significant indicators are shown with an Asterix (*).*

Passing

In the matches where a goal was scored 202±45.3 passes were performed, whereas in the 5-minutes leading up to a goal being scored 25±8.7 were played (**Table 2.9**). This equated to 1.5±0.5 passes per minute in the full duration of the match (90-minutes) and 4.9±1.7 passes per minute in the 5-minutes leading up to a goal scored. In terms of forward passing, 118±14.4 forward passes were performed and in the 5-minute period 15±4.8 forward passes were played (**Table 2.9**). This equates to 1.3±0.2 forward passes per minute in the full-match and 3.1±1.0 forward passes per minute in the 5-minute period. Results show that the rates of both total passes and forward passes played in the 5-minutes before a goal were significantly different from those performed in the full-match (3.4±0.5, P<0.05; 3.8±0.5, P<0.05).

The ROC area under the curve was statistically significant for both the mentioned performance indicators (P<0.001), with a sensitivity of 92.9% and specificity of 0% as a cut-off point of 2.75 passes per minute. These data derived overall accuracy of 0.9645 and thus an error rate of 0.0335 (**Figure 3**). Further a sensitivity of 100% as well as a specificity of 0% was found at a cut-off coordinate of 1.2625 for forward passes per minute (**Figure 4**). These data derived overall accuracy of 1 and thus an error rate of 0 for this given parameter.





F

Final Third

In the matches where a goal was scored, the team investigated made 32±6.2 entries into the opposition’s penalty area, whereas in the 5-minutes leading up to a goal being scored 4±2.0 entries into the box were made (**Table 2.9**). The equated to 0.224±0.03 entries into the box per minute in the full 90-minute match and 0.843±0.4 entries per minute in the 5-minute period investigated before a goal was scored (**Figure 5**). In regard to the opposition, in the matches where a goal was scored 25±5.7 entries were made into the box and 2±2.1 in the 5-minutes leading to a goal. This equated to 0.279±0.06 entries into the box per minute for the full-match duration and 0.457±0.42 entries per minute for the 5-minute period equivalent (**Table 2.9**). Results show that the entries made into the box by the investigated team in the 5-minutes leading up to a goal being scored was significantly different from those performed in the 90-minute match (0.62±0.11, P<0.05), however these significant differences were not found for the entries made into the penalty area by the opposing team (-0.29±0.19, P=0.141). The ROC area under the curve was statistically significant (P<0.001) with sensitivity of 92.9% and specificity of 0% at a cut-off coordinate of 0.3375 penalty area entries per minute. This data derived overall accuracy of 0.9645 and thus an error rate of 0.0355.

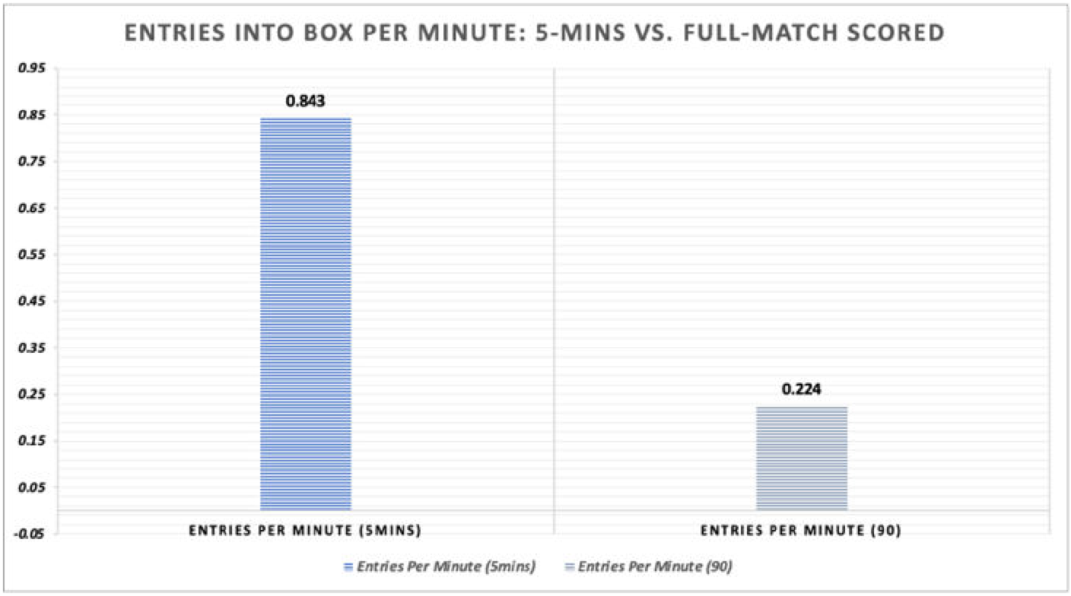


Figure 5

Physical Outputs

The team covered 1300.1±241.3m of distance at high-intensity in matches where a goal was scored, whereas in the 5-minutes leading up to a goal being converted 65.7±17.5m was completed. This equated to 12.3±3.5m per minute in the full-match, and 13.1±3.5m per minute in the 5-minute period preceding a goal (**Table 2.9**). In terms of sprint count, 277.5±43.4 sprints were completed by the team across the matches where a goal was scored, and in the 5-minute period 24±8.9 sprints were performed. This equated to 4.2±0.5 sprints per minute in the 90-minute match, and 4.4±1.6 sprints per minute in the 5-minutes leading up to a goal being scored (**Table 2.9**). Lastly, the team covered a total sprint distance of 940.9±180.8m in the matches where a goal was scored, and 50.5±3.9m of sprint distance in the 5-minutes preceding a goal. This equated to 8.8±1.3m covered per minute in the full-match, and 10.1±2.8m per minute in the 5-minutes leading up to a goal (**Table 2.9**).

Results show that no significant differences were seen between the 5-minutes leading up to a goal being scored and the full 90-minute match for high-intensity distance covered, sprint count and sprint total distance (0.8±1.1, P=0.465, 0.8±0.5, P=0.113, 1.3±0.9, P=0.144, respectively).

3.3 – Percentage Parameters

Parameter	% Parameters – Matches Goal Scored	
	Full-Match Mean±SD	5-Mins Mean±SD
Dribbles Completed (%)	**65.6±4.1**	**57.2±31.5**
Aerial Duels Won (%)	**56.2±4.5**	**58.8±16.1**
Tackles Won (%)	**58.8±9.6**	**69.6±21.1**
Successful Passes (%)	**73.3±6.0**	**76.8±10.9**
Successful FWD Passes (%)	**62.8±10.3**	**69.2±13.6**
BWD/Lateral Passes (%)	**40.9±8.2**	**35.3±11.7**
Shots on Target (%)	**50.8±8.4**	**83.3±20.3***
Successful Crosses (%)	**52.5±11.6**	**51.5±33.0**

Table 3 - *Presents the Mean±SD for the selected percentage parameters. These are shown as outputs for both the full 90-minute match, as well as the outputs recorded the 5-minutes preceding a goal scored. Statistically significant indicators are shown with an Asterix (*).*

Passing

In the matches where a goal was scored 73.3±6.0% of passes were successful, and in the 5-minutes before a goal was scored 76.8±10.9% of passes were successful (**Table 3**). The percentage of successful passes completed in the 5-minutes leading up to a goal were not significantly different from the full-match data (3.4±3.5, P= 0.321). Mean data demonstrated 62.8±10.3% of forward passes were successful in the matches where a goal was scored, and in the 5-minutes before a goal was scored 69.2±13.6% of forward passes were successful (**Table 3).** The percentage of successful forward passes completed in the 5-minutes leading up to a goal were not significantly different from the full-match data (6.4±4.7, P=0.191). Furthermore, the percentage of passes performed that were played backwards or laterally in matches where a goal was scored was 40.9±8.2%, and in the 5-minutes preceding a goal 35.3±11.7% of passes were BWD/LAT (**Table 3**). The percentage of BWD/LAT passes played in the 5-minutes leading up to a goal were not different from the full-match data (-5.5±4.0, P=0.174).

Final Third

In the matches where a goal was scored 52.5±11.6% of crosses were successfully completed, and in the 5-minutes preceding a goal 51.5±33.0% of crosses were successful (**Table 3).** The percentage of successful crosses completed in the 5-minutes leading up to a goal were not different from the full-match data (-0.99±9.7, P=0.919). Continually 50.8±8.4% of shots were on target in the matches where a goal was scored, and in the 5-minutes leading up to a goal 83.3±20.3% of shots were on target (**Figure 6**). The percentage of shots on target in the 5-minutes leading up to a goal were significantly different from the full-match data (Test Statistic = 3.356, P<0.05).

The ROC curve is presented in **Figure 7** below. The ROC area under the curve was statistically significant (P<0.001) with sensitivity of 78.9% and specificity of 0% at a cut-off coordinate of 63.2% of shots on target. This data derives overall accuracy of 0.8945 and thus an error rate of 0.0335.

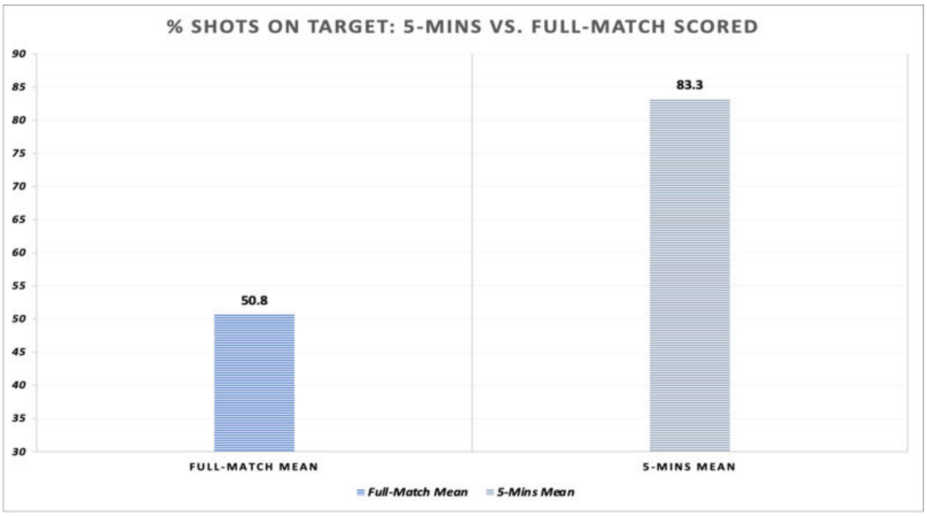


Figure 6

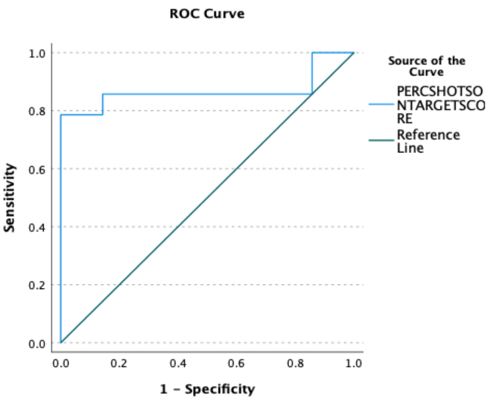


Figure 7

Technical Parameters

Within the matches where a goal was scored 65.6±4.1% of dribbles were completed, 56.2±4.5% of aerial duels were won, and 58.8±9.6% of tackles were won. In the 5-minutes before a goal was scored 57.2±31.5% of dribbles were completed, 58.8±16.1% of aerial duels were won and 69.9±21.1% of tackles were won (**Table 3**). Results show that percentage of dribbles completed, aerial duels won, and tackles won in the 5-minutes preceding a goal being scored were not significantly different from the full-match data (-8.4±10.1, P=0.413; 2.6±4.6, P=0.577; 10.9±6.4, P=0.109, respectively.

3.4 – Absolute Parameters

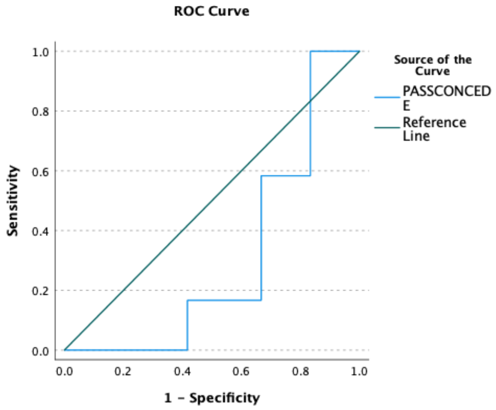
Absolute Parameters Mean±SD – Matches Goal Conceded				
Parameter	**Full-Match Mean±SD**	**5-Mins Mean±SD**	**Full-Match Minutes Mean±SD**	**5-Mins Minutes Mean±SD**
FWD Passes (n)	**133±21.1**	**12±5.3**	**1.5±0.2**	**2.4±1.1***
Passes (n)	**254±53.9**	**20±10.7**	**2.3±0.5**	**4.1±2.1***
Entries into Box For (n)	**34±8.3**	**3±1.7**	**0.3±0.1**	**0.6±0.4***
Entries into Box Opp. (n)	**25±6.8**	**4±2.6**	**0.279±0.08**	**0.750±0.51***
High-Intensity Distance (m)	**1146.1±140.5m**	**64.3±16.34m**	**11.2±1.7m**	**12.9±3.3m**
Sprint Total Distance (m)	**855.5±128.9m**	**47.3±14.4m**	**8.4±1.4m**	**9.5±2.9m**
Sprint Count (n)	**353.6±53.1**	**25.7±6.4**	**3.9±0.6**	**5.1±1.3***

Table 4 - *Above is the Mean±SD outputs for the selected absolute parameters. These are show as outputs for the full 90-minute match, as well as the outputs scaled per minute in the 5-minute period leading up to a goal being conceded for the selected absolute parameters. Statistically significant indicators are shown with an Asterix (*).*

Passing

In the matches where a goal was conceded 254±53.9 passes were performed, whereas in the 5-minutes leading up to a goal being scored 20±10.7 passes were played (**Table 4**). This equated to 2.3±0.5 passes per minute in the full-match and 4.1±2.1 passes per minute in the 5-minutes preceding a goal conceded (**Table 4**). In terms of forward passing in the matches a goal was conceded 133±21.1 forward passes were performed and in the 5-minute period 12±5.3 forward passes were played. This equated to 1.5±0.2 forward passes per minute in the 90-minute match, and 2.4±1.1 forward passes per minute in the 5-minute period preceding a goal being conceded (**Table 4**). Results show that passes and forward passes played in the 5-minutes before a conceded goal was significantly different from the full-match data (-1.7±0.7, P<0.05; -2.5±0.5, P<0.05, respectively).

The ROC curves for passes and forward passes are presented in **Figures 8 and 9** below, respectively. The ROC area under the curve was statistically significant for both the mentioned performance indicators (P<0.001), with a sensitivity of 100% and specificity of 83.3% as a cut-off coordinate of 1.8294 passes per minute. These data derived overall accuracy of 0.5835 and thus an error rate of 0.4165. Further a sensitivity of 75% and a specificity of 0% was found at a cut-off point coordinate of 1.5438 for forward passes per minute. These data derived overall accuracy of 0.875 and thus an error rate of 0.125 for this given parameter.



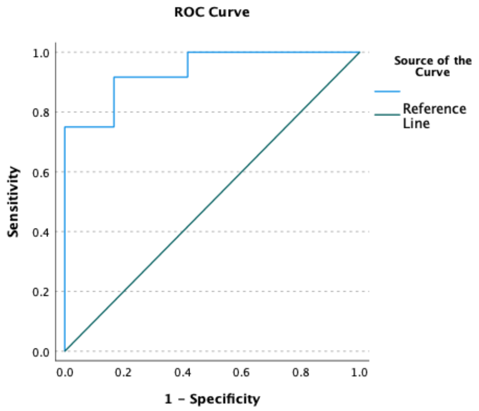


Figure 8

Final Third

In the matches where a goal was conceded the team made 34±8.3 entries into the opposition's penalty area, whereas in the 5-minutes leading up to a goal being conceded 3±1.7 entries into the box were made (**Table 4**). This equated to 0.3±0.1 entries per minute per minute in the full 90-minute match and 0.6±0.4 entries per minute in the 5-minute period preceding a conceded goal (**Table 4**). In regard to the opposition, in the matches where a goal was conceded 25±6.8 entries were made by the rival and 4±2.6 entries into the box were made in the 5-minutes preceding a conceded goal (**Table 4**). This equated to 0.279±0.08 opposition entries into the box per minute for the full match duration, and 0.75±0.5 entries per minute for the 5-minute equivalent (**Figure 10**). Results indicate that entries into the box by the investigated team in the 5-minute period preceding a goal being conceded was significantly different from the full-match data (-0.3±0.1, P<0.05), likewise the same was found for the entries into the box made by the opposing team (-0.5±0.2, P<0.05).

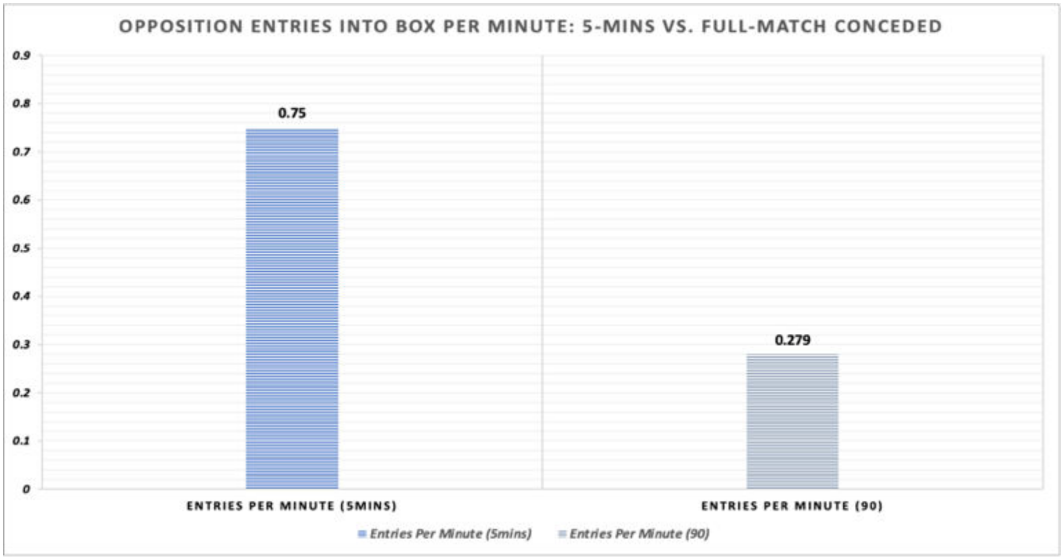


Figure 10

The ROC area under the curve was statistically significant for both the mentioned performance indicators (P<0.001; P<0.05, respectively), with a sensitivity of 100% and specificity of 91.7% as a cut-off coordinate of 0.0733 entries into the box per minute. These data derived overall accuracy of 0.5415 and thus an error rate of 0.4585. Further a sensitivity of 75% and a specificity of 0% was found at a cut-off coordinate of 0.3833 opposition entries into the box per minute. These data derived overall accuracy of 0.875 and thus an error rate of 0.125.

Physical Parameters

In the matches where a goal was conceded the team covered 1146.1±140.5m of distance at high-intensity, and in the 5-minute period preceding a goal 64.3±6.4m of high-intensity distance was completed. This equated to 11.2±1.7m of HID covered per minute for the full-match, and 12.9±3.3m per minute in the 5-minutes preceding a conceded goal (**Table 4**). In terms of sprint count, 353.6±53.1 sprints were made by the team across the matches where a goal was conceded, and in the 5-minute period 25.7±6.4 sprints were performed. This equated to 3.9±0.6 sprints per minute in the full-match, and 5.1±1.3 sprints per minute in the 5-minute period preceding a goal being conceded (**Figure 11**). Lastly, the team covered a total sprint distance of 855.5±128.9m in matches where a goal was conceded, and 47.3±14.4m sprint total distance in the 5-minutes leading up to conceding. This equated to 8.4±1.4m of sprint distance per minute for the full-match duration, and 9.5±2.9m of sprint distance per minute in the 5-mins leading up to a goal being conceded (**Table 4**).

Results show that no significant differences were seen between the 5-minutes preceding a goal being conceded and the full 90-minute match data for sprint total distance and distance covered at high-Intensity (-1.7±1.1, P=0.143; -1.1±1.0, P=0.272, respectively), however for sprint count, the 5-minutes leading up to conceding was significantly different from those performed in the full-match (-1.2±0.4, P<0.05).

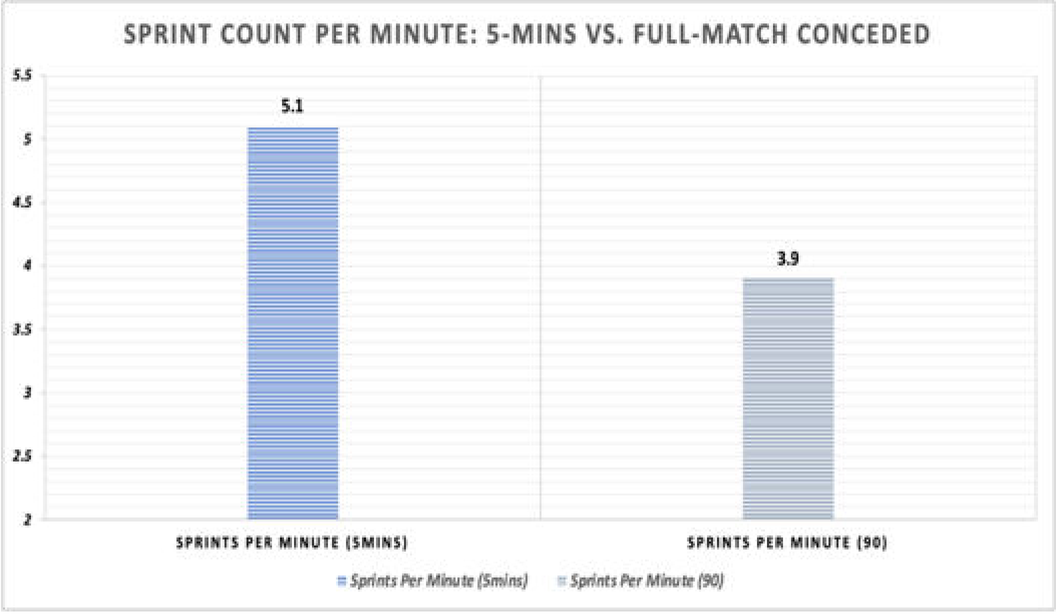


Figure 11

The ROC curve for sprint count is presented in **Figure 12** below. The ROC area under the curve was statistically significant (P=0.001) with sensitivity of 16.7% and specificity of 41.7% at a cut-off coordinate of 4.8333 sprints per minute. This data derived overall accuracy of 0.375 and thus an error rate of 0.6.

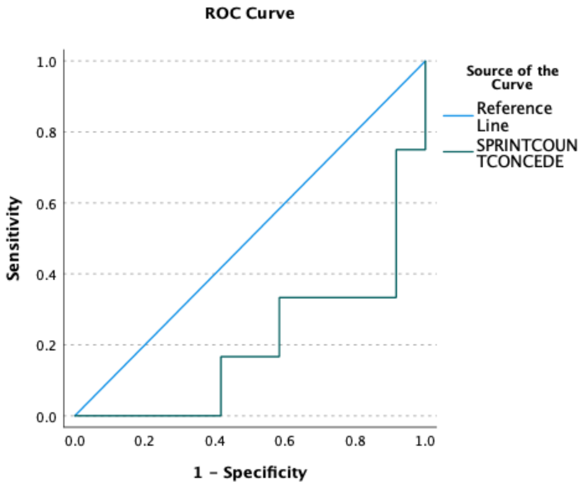


Figure 12

3.4 – Percentage Parameters

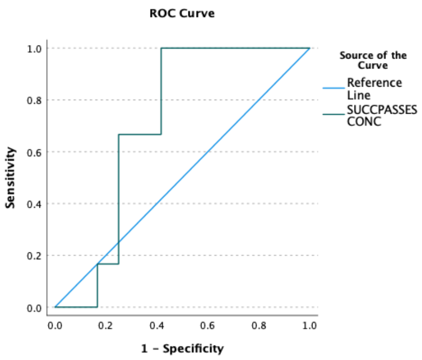
Parameter	% Parameters – Matches Goal Conceded	
	Full-Match Mean±SD	5-Mins Mean±SD
Dribbles Completed (%)	**59.5±4.5**	**57.6±32.5**
Aerial Duels Won (%)	**53.9±4.9**	**51.5±73.6**
Tackles Won (%)	**52.1±8.0**	**35.8±25.8***
Successful Passes (%)	**73.8±7.5**	**64.0±14.2***
Successful FWD Passes (%)	**58.9±9.7**	**56.7±19.0**
BWD/Lateral Passes (%)	**47.9±5.6**	**37.9±14.1***
Shots on Target (%)	**58.4±9.4**	**46.7±45.3**
Successful Crosses (%)	**49.9±12.9**	**21±30.5***

Table 5 – *Above is the Mean±SD for the selected percentage parameters. These are shown as outputs for both the full 90-minute match, as well as the outputs recorded the 5-minutes preceding a goal conceded. Statistically significant indicators are shown with an Asterix (*).*

Passing

In the matches where a goal was conceded 73.8±67.5% of passes were successful, and in the 5-minutes before a goal was scored 64.0±14.2% of passes were successful. The percentage of successful passes completed in the 5-minutes leading up to a goal conceded was significantly different from the full-match data (9.8±4.9, P<0.05). The mean data indicated 58.9±9.7% of forward passes were successful in matches where a goal was conceded, and in the 5-minutes before a conceded goal 50.7±19.0% of forward passes were successful (**Table 5**)**.** The percentage of forward passes successful completed in the 5-minutes leading up to a goal conceded were not significantly different from the full-match data (8.3±6.4, P=0.211). Furthermore, the percentage of passes performed that were played backwards or laterally in matches where a goal was conceded was 47.9±5.6%, and in the 5-minute period 37.9±14.1% of passes were BWD/LAT (**Table 5**). Results show that the percentage of BWD/LAT passes played in the 5-minutes leading up to a goal was significantly different from the full-match data (9.9±4.6, P<0.05).

The ROC curve for the percentage of successful passes and the percentage of BWD/LAT passes are presented in **Figure 13 and 14**, respectively. The ROC area under the curve was not statistically significant (P-0.08, P=0.096, respectively) for either of the mentioned performance indicators, with sensitivity of 100% and specificity of 41.7% at a cut-off coordinate of 63% for percentage of successful passes. This data derived overall accuracy of 0.7915 and thus an error rate of 0.2085. Further a sensitivity of 91.7% and specificity of 41.7% at a cut-off coordinate of 40.3% was found for percentage of BWD/LAT passes. This data derived an overall accuracy of 0.75 and thus an error rate of 0.25.



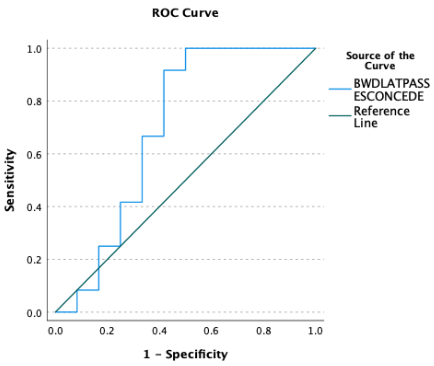


Figure 13

Fig

Final Third

In the matches where a goal was conceded 49.9±12.9% of crosses were successfully completed, and in the 5-minutes preceding a goal 21.0±30.5% of crosses were successful (**Figure 15).** Results show that the percentage of successful crosses completed in the 5-minutes leading up to a goal conceded was significantly different from the full-match data (Test Statistic: 2.752, P<0.05). Continually, a mean of 58.4±9.4% of shots were on target in the matches where a goal was scored, and in the 5-minutes leading up to a goal 46.7±43.3% of shots were on target (**Table 5**). The percentage of shots on target in the 5-minutes leading up to a goal was not different from the full-match data (Test Statistic = 0.99, P=0.347).

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The ROC curve is presented in **Figure 16** below. The ROC area under the curve was statistically significant (P<0.001) with sensitivity of 100% and specificity of 33.3% at a cut off coordinate of 29.04% of successful crosses. These data derived overall accuracy of 0.835 and thus an error rate of 0.165.

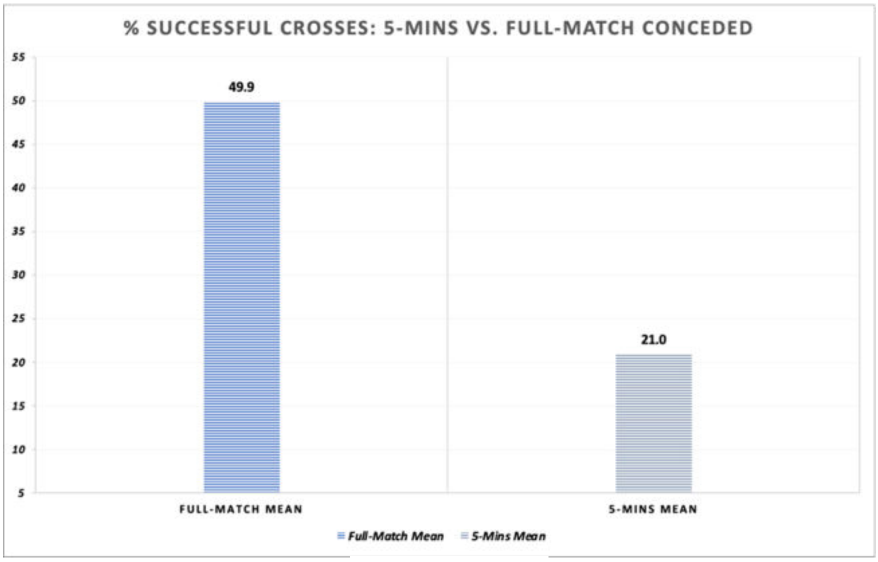


Figure 15

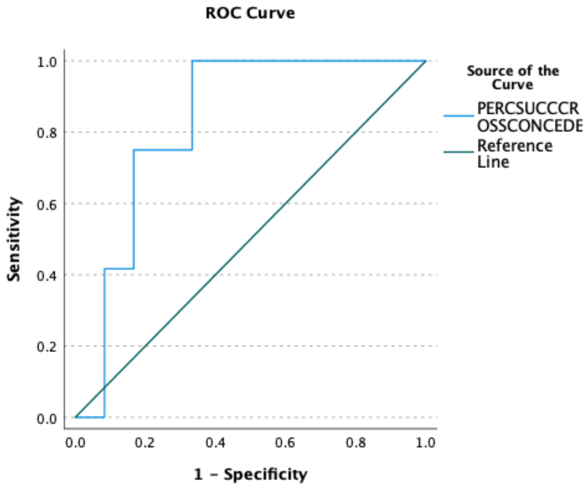


Figure 16

Technical Parameters

Within the matches where a goal was scored 59.5±11.5% of dribbles were completed, 53.9±4.9% of aerial duels were won, and 52.1±8.0% of tackles were won. In the 5-minutes before a goal was scored 57.6±32.5% of dribbles were completed, 51.5±13.6% of aerial duels were won and 35.3±25.8% of tackles were won (**Table 5**). Results show that percentage of dribbles completed, and the percentage of aerial duels won, in the 5-minutes preceding a goal being scored were not different from the full-match data (1.9±10.4, P=0.859; 2.4±4.5, P=0.587, respectively). However, results show that for percentage of tackles won in the 5-minutes preceding a goal being conceded was significantly different from the full-match data (16.9±8.1, P<0.05).

The ROC curve for percentage of tackles won is presented below in **Figure 17**. The ROC area under the curve was not statistically significant (P=0.064), with sensitivity of 100% and specificity of 33.3% at a cut-off coordinate of 44.6% tackles won. This data derived overall accuracy of 0.8335 and thus an error rate of 0.1605.

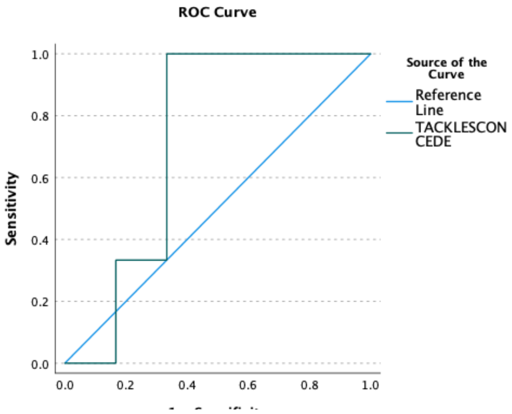


Figure 17

3.5 – Positional Groups

In the present investigation, data for four positional groups was also analysed. The stratified positions were those of forwards (including wide forwards), midfielders (including wide midfielders), wide-defenders and central defenders. Physical parameters and the given outputs from these positional groups were explored for each of the ten matches.

3.6 - Goals Scored

In Appendix B tables 6.1 – 7.5 present the descriptive statistics in each of the parameters explored in the present investigation, stratified by positional group. All SPSS outputs can be viewed in Appendix C.

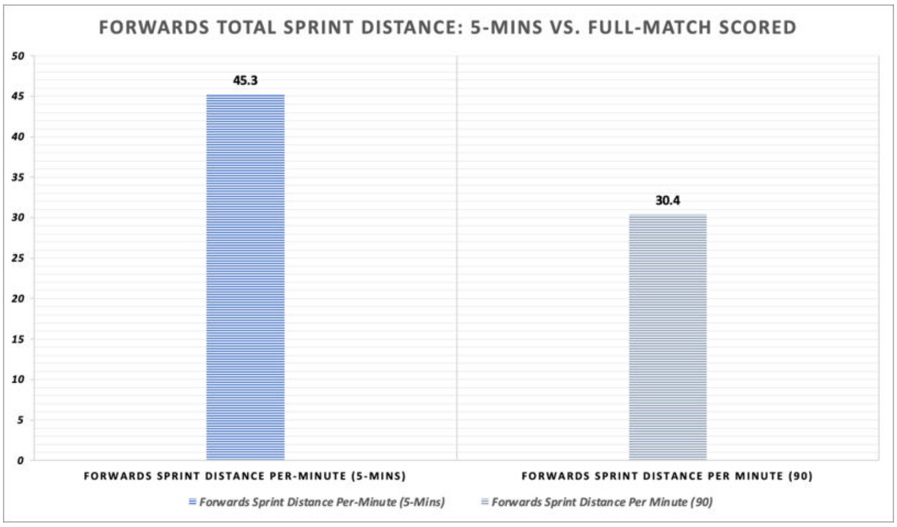
Positional Outputs for Physical Parameters – Mean±SD for Matches Goals Scored					
Physical Parameter	**Positional Group**	**Full-Match Mean±SD**	**5-Mins Mean±SD**	**Full-Match Minutes Mean±SD**	**5-Mins Minutes Mean±SD**
Sprint Count (n)	**Forwards**	**120±38.7**	**8±3.1**	**1.3±0.4**	**1.7±0.6**
Sprint Total Distance (m)	**Forwards**	**2736.6±786.7**	**226.4±70.9**	**30.4±8.7**	**45.3±14.2***
HID Covered (m)	**Midfielders**	**2114.9±581.2**	**155.4±46.8**	**23.5±6.5**	**31.1±9.4***
Sprint Count (n)	**Wide-Defenders**	**91.4±9.1**	**4.7±2.3**	**1.1±0.1**	**0.9±0.5**
Distance Covered (m)	**Central Defenders**	**16635.7±3408.5**	**882.7±125.4**	**184.8±37.9**	**176.5±25.1**

Table 8 (above) – *Mean±SD outputs for the selected parameters and positions. These are shown as outputs for both the full 90-minute match, as well as the outputs recorded in the 5-minutes preceding a scored goal. Statistically significant indicators are shown with an Asterix (*).*

Forwards

In the matches where a goal was scored, forwards were seen to complete a total sprint distance of 2736.6±786.7m, whereas in the 5-minutes leading up to a goal being scored a total sprint distance of 226.4±70.9m was completed (**Table 8**). This equated to 30.4±8.7m of total sprint distance per minute in the full-match, and 45.3±14.2m per minute in the 5-minute period preceding a goal (**Figure 18**). In regard to sprint count, 120±38.7 sprints were performed by forwards in a full 90-minute match in which a goal was scored, and in the 5-minutes preceding a goal 8±3.1 sprints were performed by forwards. This equated to 1.3±0.4 sprints pre minute in the full-match and 1.7±0.6 sprints per minute in the 5-minutes preceding a goal being scored (**Table 8**). Results show that for the forwards sprint count no significant differences were seen between the 5-minutes leading up to a goal being scored and the full 90-minute match (0.4±0.2, P=0.115). However, the sprint total distance completed by forwards in the 5-minutes preceding a goal was significantly different from the equivalent output in the full-match (11.5±3.7, P<0.05).

The ROC curves for sprint total distance completed by forwards are presented in below in **Figure 19** The ROC area under the curve was statistically significant (P<0.001) for the mentioned performance indicator, with a sensitivity of 64.3% and specificity of 0% at a cutoff coordinate of 43.9m total sprint distance per-minute. This data derived overall accuracy of 0.8215 and thus an error rate 0.1785.



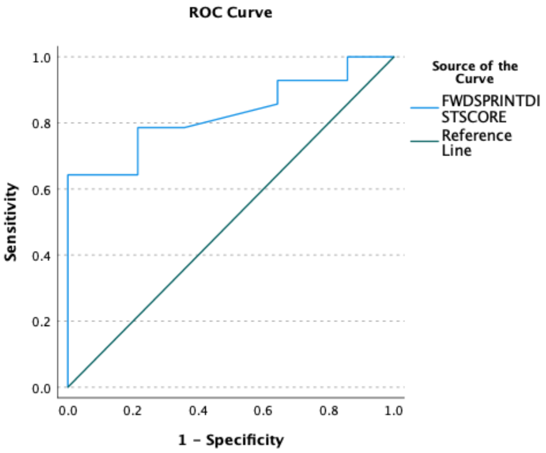
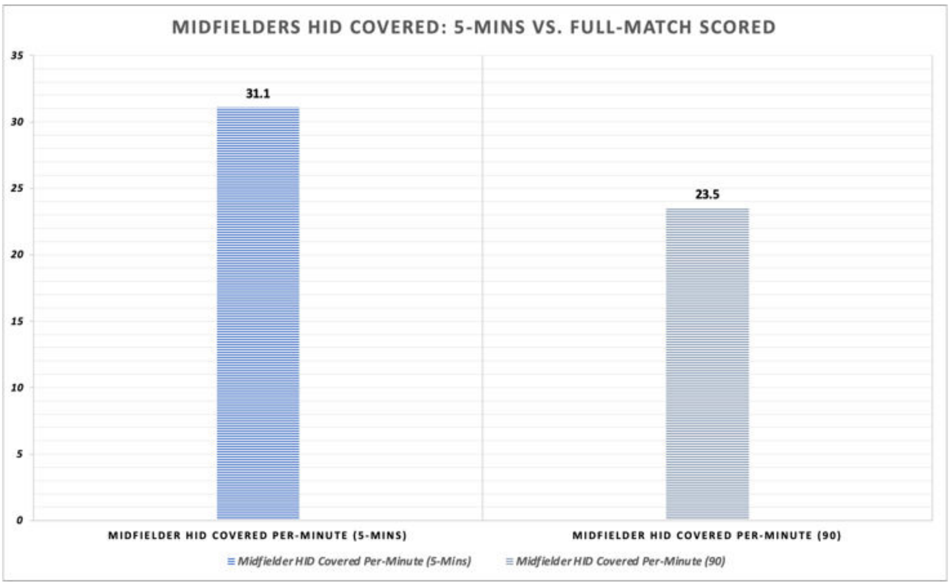


Figure 18

Figure 19

Midfielders

In the matches where a goal was scored, midfielders were seen to cover 2114.9±581.2m of distance at high intensity, and 155.4±46.8m of HID in the 5-minutes preceding a goal (**Table 8**). This equated to 23.5±6.5m of HID covered per minute in the full-match, and 31.1±9.4m per minute in the 5-minute period leading up to a goal being scored (**Figure 20**). Results show that the HID covered by midfielders in the 5-minutes preceding a goal was significantly different from the full-match data (7.6±3.2, P<0.05). The ROC curves for HID covered by midfielders are presented below in **Figure 21** The ROC area under the curve was statistically significant (P<0.001), with a sensitivity of 50% and specificity of 0% at a cut-off coordinate of 33.7m. This data derived overall accuracy of 0.75 and thus an error rate of 0.25.



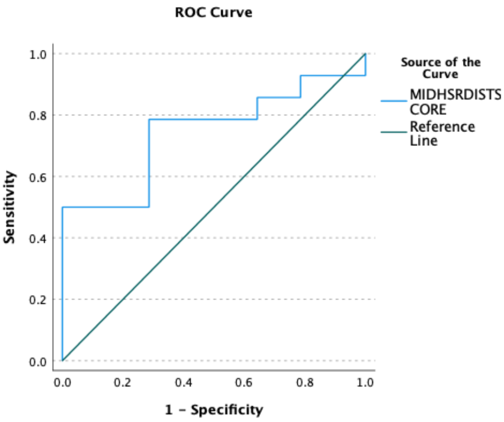


Figure 20

Defenders

In matches where a goal was scored 91.4±9.1 sprints were performed by wide-defenders, whereas in the 5-minutes preceding a goal being scored 4.7±2.3 sprints were completed. This equated to wide defenders completing 1.1±0.1 sprints per minute in the full 90-minute match and 0.9±0.5 sprints per minute in the 5-minutes before a goal (**Table 8)**. Results show that no significant differences were seen between the 5-minutes leading up to a goal being scored and the full 90-minute match for the wide defender's sprint count (-0.1±0.1, P=0.578). The same was observed for central defenders. This playing position covered a distance of 16635.7±3408.5m (16.6km), whereas in the 5-minutes leading up to a goal being scored 882.7±125.4m of distance was covered. This equated to 184.8±37.9m of distance covered per minute in the full 90-minute match, and 176m5±25.1m of distance covered per-minute in the 5-minutes preceding a goal (**Table 8**). Results show that no significant differences were seen between the 5-minutes leading up to a goal and the full-match data for this given parameter and positional group (-8.3±12.6, P=0.516).

3.7 – Goals Conceded

Positional Outputs for Physical Parameters – Mean±SD for Matches Goals Conceded					
Physical Parameter	**Positional Group**	**Full-Match Mean±SD**	**5-Mins Mean±SD**	**Full-Match Minutes Mean±SD**	**5-Mins Minutes Mean±SD**
Sprint Count (n)	**Forwards**	**90±32.8**	**6±2.3**	**1.0±0.4**	**1.3±0.5**
Sprint Total Distance (m)	**Forwards**	**1938.3±747.8**	**169.2±68.9**	**21.5±8.3**	**33.8±13.7***
HID Covered (m)	**Midfielders**	**1869.7±362.9**	**200.1±71.5**	**20.8±4.1**	**40.1±14.3***
Sprint Count (n)	**Wide-Defenders**	**88.4±6.5**	**6.3±2.1**	**1.0±0.1**	**1.3±0.4***
Distance Covered (m)	**Central Defenders**	**16458.3±4963.8**	**948.4±123.1**	**182.9±55.2**	**189.7±24.6**

Table 9 (above) – *Mean±SD outputs for the selected parameters and positions. These are shown as outputs for both the full 90-minute match, as well as the outputs recorded in the 5-minutes preceding a conceded goal. Statistically significant indicators are shown with an Asterix (*).*

Forwards

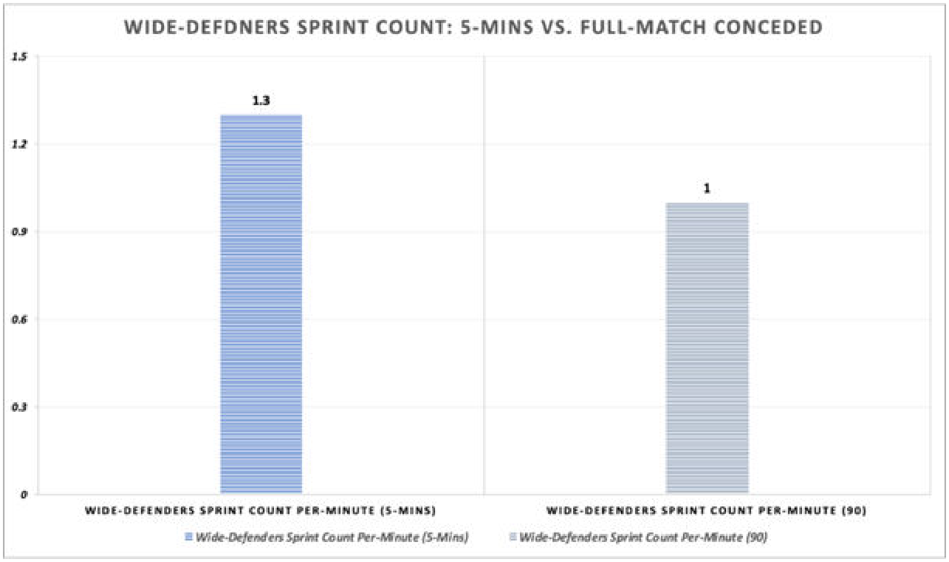
In the matches where a goal was conceded forwards completed 1938.3±747.8m of sprint total distance, whereas in the 5-minutes leading up to a goal being conceded 169.2±68.9m of sprint distance was completed by forwards. This equated to a total sprint distance of 21.5±8.3m per minute in the full-match, and 33.8±13.7m per minute in the 5-minutes preceding a goal (**Table 9**). Furthermore, in regard to sprint count, forwards performed 90±32.8 sprints in the full 90-minute match, and 6±2.3 sprints in the 5-minutes preceding a goal conceded. This equates to 1.0±0.4 sprints per minute in the full match, and 1.3±0.5 in the 5-minutes leading up to a conceded goal (**Table 9**). Results show that for the forwards sprint count no significant differences were seen between the 5-minutes leading up to a goal being conceded and the full 90-minute match (-0.3±0.2, P=0.144). Similarly, to goals scored the sprint total distance completed by forwards in the 5-minutes preceding a goal being conceded was seen to be significantly different from the equivalent output in the full-match (-12.3±4.78, P<0.05). Results depicted in **Figure 19** above were similar for goals conceded surrounding the mentioned performance indicator. The ROC area under the curve was statistically significant (P<0.001), with a sensitivity of 41.7% and specificity of 0% at a cut-off coordinate of 40.4m total sprint distance per-minute. This data derived overall accuracy of 0.7085 and thus an error rate 0.2915.

Midfielders

In the matches where a goal was conceded midfielders were seen to cover 1869.7±362.9m of distance at high-intensity, and in the 5-minutes preceding a conceded goal 200.1±71.5m was completed. This equated to 20.8±4.1m of distance covered at high-intensity per minute by midfielders in the full 90-minute match, and 40.1±14.3m per minute in the 5-minutes leading up to a goal being conceded (**Table 9**). Similarly, to goals scored results show that the HID covered by midfielders in the 5-minutes preceding a conceded goal are significantly different from the equivalent full-match data (-19.2±4.4, P<0.05). Results depicted in **Figure 21** above were similar for goals conceded surrounding this parameter. The ROC area under the curve was statistically significant (P<0.001), with sensitivity of 100% and a specificity of 33.3% at a cut-off coordinate of 31.9556m of HID covered per minute. This data derived overall accuracy of 0.8335 and thus an error rate of 0.1665.

Wide Defenders

In the matches where a goal was conceded, wide defenders were observed to perform 88.4±6.5 sprints in the full 90-minute match, whereas in the 5-minutes leading up to a goal being conceded 6.3±2.1 sprints were performed (**Table 9**). This equated to 1.0±0.1 sprints performed by wide defenders per minute in the full-match, and 1.3±0.4 sprints per minute in the 5-minutes preceding the conceded goal (**Figure 22**). Results show that wide defenders sprint count in the 5-minutes preceding a conceded goal was significantly different from the full-match data (-0.3±-0.5, P<0.05). The ROC curve for this mentioned parameter and positional group can be seen in **Figure 23.** The ROC area under the curve was not statistically significant (P=0.147), with sensitivity of 58.3% and specificity of 0% at a cut-off coordinate of 1.1389. This data derived an overall accuracy of 0.7915 and thus an error rate of 0.2085.



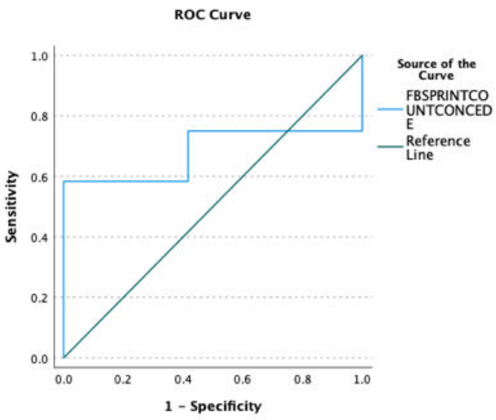


Figure 22

Central Defenders

In the matches where a goal was conceded central defenders covered a total distance of 16458.3±4963.8m, and in the 5-minutes preceding a goal covered 948.4±123.1m. This equated to 182.9m distance covered per minute by central defenders, and in the 5-minutes preceding a conceded goal 189.7±24.6m of distance was covered for the equivalent (**Table 9**). Results show that no significant differences were seen between the 5-minutes leading up to a goal being conceded and the full 90-minute match for the distance covered by central defenders (-6.8±-44.6, P=0.712).

4 - DISCUSSION

Identifying performance indicators associated with offensive and defensive prowess is of vital importance to coaches, practitioners, and analysts alike when assessing performance data. The aim of the present investigation was to identify technical and physical key performance indicators that appear to contribute to positive and negative outcomes throughout a match and in football performance. Exploratory factors, such as the 5-minutes preceding a goal (scored and conceded) outlined at the onset of the study, identified aspects of performance that appear to be linked to goal outcomes. The factors most associated with goal-scoring and goal-conceding, and perhaps most importantly to what threshold could provide invaluable information to coaches in planning, preparing, and advising players and tactics for competition.

Passing

Passing in football has a direct correlation with possession of the ball. Often a discriminatory factor of a successful football team, early research found differences between winning and losing teams passing frequencies (Grant et al., 1999), whilst Hook and Hughes (2001) suggested successful teams had greater ball possession but finding no significant differences in the number of passes that led to goals. It is interesting to note that the present investigation found that the studied team performed more passes in total as well as on average in matches they lost and drew, compared to matches they won (Table 2.1 and 2.2). This agrees with more recent research (Lago-Peñas et al., 2011; Delgado-Bordonau et al., 2013) which found significantly more passes were performed when teams lost compared to winning and drawing outcomes (469.7±102.8, $53.7±95.8 and 441±88.1, respectively). This is likely a result of winning teams backing off to absorb pressure, whilst the team in a deficit requires possession of the ball in order to create goal-scoring opportunities to equalise.

Investigations into score-line effects on football performance have always looked at the periods of matches in which a given team is winning, losing, or drawing. Redwood-Brown (2008) sought to analyse passing patterns before and after goal-scoring in the English Premier League, focusing on the 5-minutes that preceded and followed a goal. The mentioned study aimed to highlight the effect of scoring on the number of passes performed and the accuracy of such passes for both scoring and conceding teams. One of Redwood-Browns (2008) key findings was that scoring teams showed higher passing frequencies and rates of successful passes in the 5-minutes before scoring a goal when compared to the overall half in which the goal was scored. Continually, conceding teams were seen to perform far fewer passes in the 5-minutes preceding a conceded goal. Present findings support this research, whereby the number of passes performed in the 5-minutes preceding a scored goal, as well as a conceded goal, evoked statistically significant differences from the full-match data (Table 2.9). Fernandez-Navarro et al. (2016) suggested passing direction is a good indicator of both offensive and defensive playing styles, most notably possessional and direct equivalents. In the 5-minutes preceding a conceded goal the number of forward passes performed also extracted statistically significant differences from the full-match equivalent. These findings suggests that the fewer forward passes performed in the 5-minutes preceding a goal being conceded is good evidence for conceding teams not penetrating the opposition, whilst fewer total passes clearly shows that when teams have less custody of the ball, and potentially obviously their likelihood of conceding is increased.

Successful performance is often supported by teams performing a higher percentage of forward passes, along with a lower percentage of lateral and backward passes (Redwood-Brown, 2008). The present investigation supports the notion that a higher percentage of forward passes is an indicator of successful attacking play (Yang et al., 2018), as the studied team performed a higher percentage of the aforementioned in winning outcomes compared to fixtures they lost (64±6.7%, 55±4.5%, respectively). Descriptive data here suggest that successful teams are able to use a wider variety of passes as a tool to create shooting opportunities. This enables teams to become less predictable when attacking, generating higher goal-scoring frequencies (Hughes and Franks, 2005). The present investigation has highlighted similar findings, whereby passing, and forward passing frequency in the 5-minutes preceding a scored goal elicited statistically significant differences from the full-match data (Table 2.9), which draws interesting parallels with the deliberations surrounding optimal passing sequences (Wright et al., 2011; Tenga et al., 2010b; Hughes and Franks, 2005; Carling, Williams, and Reilly, 2007). It is argued that more successful teams utilise a greater array of passing strategies to outwit opponents, and although backward and lateral passing helps to maintain custody of the ball to exploit space, forward passes that look to penetrate the oppositions 18-yard box are seen to increase the number of shots taken at goal, and as a result the number of goals scored (Filetti et al., 2017). This provides strong argument that forward passing frequencies are often indicative of strong attacking playing styles, whereas backward passes often move the ball further away from the opponent’s goal (Fernandez-Navarro et al., 2016) and potentially could indicate slow progression of possession. Lateral passes often cause imbalances in the opponent’s defensive line, stretching them wide and as a result leaving gaps to play penetrative passes and create an attack (Tenga et al., 2010a, 2010b; Tenga and Sigmundstad, 2011). A key and novel finding from the present investigation is that of the percentage of backward and lateral passes played in the 5-minutes preceding a conceded goal. Results show that the percentage of BWD/LAT passes played in the 5-minutes preceding a conceded goal were significantly different from the full-match data, whereby 40.3% of passes that are played BWD/LAT was found to predict 91.7% of conceded goals at an accuracy of 75% (Figure 14). It seems that when teams fail to take on forward-thinking passes it potentially increases pressure deeper in their defensive third, with the result that the frequency of both backward and lateral passing is discriminatory of less favourable outcomes.

Collet (2013) highlighted significant relationships between passing frequency, overall team success in domestic European leagues, yet demonstrated that efficiency mattered. In terms of evaluating effectiveness in football, passing accuracy and the conversion of ball possession into a high shot-on-goal ratio are critical indicators of effective ball possession and possession quality. Accurate passing is a factor of a successful team, whereby Evangelos and colleagues (2013) found winning teams in the Greek SuperLeague had a higher percentage of accurate passes than those teams who were defeated or tied (72.3±7.1, 69.2±6.9, 69.9±7.5, respectively). The present findings agree with such a narrative as the studied team was seen to have higher outputs for percentage of successful passes for matches that were won compared to matches that were drawn and lost (Table 2.1 and 2.2), however this wasn't deemed significant. The present study argues that higher passes to shots-on-goal ratios and unproductive, superfluous passes are key predictors of worse team outcomes across football as the studied team's percentage of successful passes and forward passes in the 5-minutes preceding a scored goal failed to highlight any statistically significantly differences from the full-match data. Although the outputs of passing and forward passing accuracy were higher in the 5-minute period than the full-match, agreeing with the findings of Redwood-Brown (2008) it seems the absence of significant differences shows passing accuracy, regardless of direction has no impact on attacking playing styles and goals. These findings do not support the notion that passing accuracy is positively and significantly correlated with total shots, shooting accuracy, goals scored and points (Collet, 2013). Contrastingly, for conceded goals it seems passing accuracy holds a greater importance, since the present investigation found that the percentage of successful passes in the 5-minutes preceding a conceded goal was significantly different from the full-match data – once more agreeing with Redwood-Brown's (2008) finding of conceding teams having lower passing success rates. The present investigation prompts passing accuracy as an indicator associated with defensive performance, as increased outputs of passing accuracy have been seen to reduce an opponents' total shots, shots taken inside the penalty area and crosses against (Jones, James and Mellalieu, 2004). In football performance this is easily applicable, as inaccurate passing often causes teams to lose possession of the ball, whereby opposition teams can more easily regain possession in advanced areas of the pitch and counter into the space created ahead of them – passing accuracy therefore can be deemed as a performance indicator concerned with defensive playing styles and remains important in training focuses.

Final Third

Scoring goals is no doubt the conclusive factor of football performance, one certainly of which coaches are arguably most concerned with because of its direct relation with winning and success (Acar et al., 2008; Armatas et al., 2009; Hughes and Franks, 2005; Wright et al., 2011). Such a determinant has seen to dominate the focus of previous performance analysis in football – but there are reasons as to why this narrative can be challenged. Simply assessing offensive play based solely on goals scored doesn't provide a holistic overview of team performance. Football teams can perform sub-optimally and still win a game or competition (Jones, James and Mellalieu, 2004), hence why classifications of good performance such as entries into the penalty area, crosses and shots on target do not always directly relate to success. The make-up of football as a sport sees these aspects of performance be related to offensive play (Garganta, 1998; Wright et al., 2011), often overlooking how attacking play creates risky situations and spaces in other areas of the pitch that can lead to teams conceding a goal. Therefore, the present investigation hoped to evaluate said aspects of game performance that seem to alter the balance between defence and offence to assess whether they have an impact on conceding goals, not solely the scoring equivalent.

A team's total number of shots has been seen to discriminate successful teams in league competitions of varying standards in multiple continents. Evangelos and colleagues (2005) examined matches from 10 European and 2 Latin American national championships in the 2004/05 and 2005/06 seasons, concluding that teams who performed more shots stood a

57.2% higher chance of winning, whilst in international competition (The World Cup) more successful teams almost always achieved more shots on goal (Hughes et al., 2005). Findings from Jankovic and colleagues (2011) saw winning teams made more shots at goal than losing teams (11.6±2.4, 9±4.1, respectively), the same was found in the current findings (16±6.0, 14±4.1, respectively). However, the number of shots held no statistically significant differences across outcome nor in the 5 minutes preceding scored goals, similar to Szwarc (2004) who reported that winning teams made only four more shots than less successful counterparts. Therefore, the present investigation does not support the notion that the more shooting opportunities a team can create the increased likelihood there is of scoring goals (Castellano et al., 2012; Armatas et al., 2009; Lago-Peñas and Lago-Ballesteros, 2010).

Castellano et al. (2012) further argued that it seems shots on target best discriminates team success, not the total number of shots. It has been agreed by several authors that the quality of shots has the highest discriminatory power in offensive play within football (Lago et al., 2010) where in the Spanish leagues Lago-Ballesteros and Lago-Peñas (2010) reported its value was significantly different between top ranked and lower ranked teams in LaLiga, whilst in in Italy's Serie A it has also been seen to separate winning and losing sides (Rampinini et al., 2009). This has also been reported for teams reaching higher levels of competition at World Cups (Lawlor et al., 2003). Such has been seen to run true in the present investigation, as findings show that in matches the studied team won the accuracy of their shots on goal were significantly higher than the equivalents in matches that were lost (66±15.5% and 40±12.2%, respectively). It is important to note that statistically significant differences were observed for the percentage of shots on target across matches with goal events (See Appendix C). Such can be attributed to successful teams converting more of their ball possession into shots at goal more frequently. Furthermore, the percentage of shots on target in the 5-minutes preceding a goal scored evoked statistically significant differences from the full-match data. Although it seems somewhat obvious that shots need to be on target in order to score, the present results further stress the importance of accuracy in critical moments of the match (Figure 6). It seems shots on target leading up to a goal scored helps keep the pressure on rival teams, as such forces saves from the goalkeeper that can be rewarded in corners and potential rebounds for strikers to pounce upon. Shots on target will prevent the ball going out of play and rewarding the opposition with goal-kicks and throw-ins that all immediately alleviate the pressure the team in question has in the final third of the pitch (Pratas, Vollossovitch and Carita, 2018). Although the quality of a team's shots is higher in successful outcomes it seems important to note then that total shots and shots on target received can be argued as critical indicators of defensive performance. Interestingly, Lago-Ballesteros and Lago-Peñas (2010) found no defence-related variables that discriminated top-ranked teams from lower-ranked teams whilst results from Castellano et al. (2012) found that averages for total shots and shots on target received for losing teams were significantly higher than those of winning and drawing equivalents. The present findings elicited no descriptive differences between the number of shots received and shots on target received across outcome (Table 2.3), which is further supported by the absence of statistically significant differences for the studied team's percentage of shots on target in the 5-minutes preceding a conceded goal and the full-match data. Therefore, there remains strong argument for future research to look at opponents shooting opportunities regarding shots and shots on target received; it remains plausible that a team's ability to avert shots on goal, especially inside the penalty area, constitutes as a very important defensive performance indicator that helps achieve more successful outcomes.

Entries into the penalty area has been a performance indicator of growing interest throughout the last two decades. Lago-Peñas, Acero and Vargas (2007) originally analysed entries into the penalty area made by FC Barcelona in their 2004-05 season in LaLiga, concluding that a relationship exists between this performance indicator and successful performance (r=0.71). A greater difference that existed between entries made by FC Barcelona into the opponent's box and entries into FC Barcelona's own penalty area the better Barcelona performed. Entries into the penalty area, academically know as 'Score-Box Possessions' has been supported since the former study as it is believed it acts as a proxy for goals and shots inside the penalty area (Tenga, Ronglan and Bahr, 2010). Ruiz-Ruiz and colleagues (2013) aimed to analyse the suitability of entries into the penalty area as an indicator that discriminates more successful teams, and whether a relationship existed between entries into the penalty area received and conceded goals. It was found that winning teams made significantly more entries into the oppositions penalty area than drawing and losing teams. The results of the present investigation are interesting however, as they seem to challenge this. The studied team made more entries into the opponent's penalty area in matches they lost compared to matches they won and drew however this was found not to be significant. This seems somewhat contradictory to previous research that has found that teams who have more entries into the penalty area and receive fewer from their opponents is indicative of good team performance (Lago et al., 2007; Ruiz-Ruiz et al., 2013). It's plausible then that the number of entries into the penalty area has no contribution to positive results, whereby it weighs more on a team's efficiency and ability when eventually reaching this area of the pitch. Present descriptive findings highlight that the entries made into the 18-yard box do not necessarily mean that goal-scoring opportunities are always the final result. However, the present investigation did uncover the number of entries into the penalty area made in the 5-minutes preceding a scored goal were significantly different from the full-match equivalents. This agreed with other aspects of Ruiz-Ruiz's et al.'s (2013) research whereby making more entries into the opposing teams penalty area dramatically increase the probability of scoring a goal as shots originating from within the 18-yard box are more likely to be effective due to a heightened ability for players to place shots nearer to the goalposts and out of the goalkeepers reach (Michailidis et al., 2004; Bergier, Soroka and Buraczewski, 2008; Acar et al., 2008).

Yiannakos and Armatas (2006) reported that in the Greek SuperLeague 44.4% of goals were scored inside the penalty area, whilst 35.2% derived inside the 6-yard box and 20.4% from outside of the 18-Yard box. However, from the present investigation this is now somewhat challenged as 21.4% of goals were seen to be scored in the 18-Yard box, whilst 78.6% of goals were scored in the 6-yard box; no goals were derived from shots at distance. This credits the importance of entries into the penalty area further, whereby the closer a team can position the ball to the opponents goal the likelihood of converting a chance is dramatically increased. Defensively, results found that the number of entries made into the penalty area by an opponent in the 5-minutes preceding a conceded goal held statistically significant differences from the full-match data. This provides supporting evidence that the fewer entries a team is seen to have into the opponent's penalty area prompts goals to be conceded (Ruiz-Ruiz et al., 2013). Although it must be remembered that the 5-minute period used in this study provides only a snapshot of a full-match, findings strongly indicate that entries into the box against is an indicator of defensive performance. Under periods of prolonged pressure opposition teams often introduce the ball into the 18-yard box to create shooting opportunities at goal, and as explored above shots taken closer to the goal have a higher conversion rate to goals. Coaches should look to analyse methods in which prevent the opposition team from carrying the ball into these areas of the pitch to neutralise play. Ultimately, entries into the penalty area remains a strong performance indicator that can be used to assess the quality of a team's attacking and defensive playing styles (Ruiz-Ruiz et al., 2013). From an offensive standpoint it seems effectiveness of any attacking playing style enables more entries into the box, but it seems the closer the ball can be allocated towards the opponent's goal (i.e., 6-yard box) the likelihood of a goal being scored is higher, hence why the total number of entries into the penalty has been observed to be indiscriminatory of outcome (Wright et al., 2011). Instead, successful results and the prevention of conceded goals are seen to be achieved instead by having fewer entries into the penalty area from an opponent.

Research from previous authors have highlighted how defensive performance indicators can have a significant influence on the performance of a team (Lago-Peñas, Lago-Ballesteros and Rey, 2012) and it has always seemed to bring about inconclusive findings which has prompted further investigations. Crossing is a tactic used to create goal-scoring chances, possessions in an opponent's 18-yard box and penetration of the final third (Ensum, Pollard and Taylor, 2005; Oberstone, 2009). Crosses may be the most effective method of analysing attacking effectiveness, especially in teams who occupy wide midfielders and attackers. Such formations look to employ long passing distributions into the strikers who create space in the penalty area, win aerial challenges and move more quickly towards a final third (Ruiz Ruiz et al., 2013). When an opponent's lacks aerial threat, then successful crossing deliveries have a higher probability of being advantageous. Therefore, the greater number of successful crosses a team can perform then potentially the more entries they can have into the opponents 18-yard box. However, crossing the ball does mean a higher risk of losing the ball with an unsuccessful delivery, creating potential counter-attacking opportunities for the opposition (Lago-Peñas et al., 2012). The present investigation looked at the studied teams crossing success rates as offensively such has been perceived to provide frequent penetration of an opponent's most vulnerable areas of the pitch. Interestingly however, no statistically significant differences were observed for the percentage of successful crosses in the 5-minutes preceding a scored goal and the full-match data. What is believed to be a novel finding in this field of research is that the percentage of successful crosses in the 5-minutes preceding a conceded goal elicited statistically significant differences from the full-match equivalents. At a threshold of 29.04% of successful crosses 100% of conceded goals can be predicted at an accuracy of 84% (Figure 15). When attacking, the loss of possession from an unsuccessful cross can be dramatic as more players have made runs into the penalty area in an attempt to meet delivery. As a result, opposing teams can adopt long passing strategies to attack against a disorganised defensive line to produce shots at goal with just one touch (Carling et al., 2005; Ruiz-Ruiz et al., 2011). Such findings prompt how successful crosses can be analysed as an indicator of defensive efficacy, whereby if crossing tactics are employed during matches and success rates are low, coaches can switch to a direct playing style in order to avert susceptibility of being caught on a counterattack, all whilst minimising the goal-scoring opportunities opponents can create.

Skill-Related Activities

Technical parameters associated with skill, such as crosses, passes, dribbles as well as both aerial and ground challenges are interesting components of performance due to their relationship with on-the-ball contributions and possession. Research has scarcely investigated such performance indicators directly with goals for and against, but instead as functional behaviours influenced by contextual factors such as match location, quality of opposition and match status (Taylor, Meilalieu, James and Shearer, 2008; Tucker, Meilalieu, James and Taylor, 2005), whilst others have aimed to explore their contributions to successful team performance (Rampinini et al., 2007). Match location, environmental conditions, pitch style, match status and level of competition have always been deemed as great influencers of match result (Carling et al., 2005; Taylor et al., 2010). Tucker and colleagues (2005) found that a British football team performed a greater number of corners (6±2.5), crosses (25±5.1), successful dribbles (17.5±8.1), successful passes (271±87.5) and shots (18±8.2) during home matches, whilst playing more clearances (52±18.4) and having more losses in possession (23±4.5) when playing away fixtures. They further highlighted that a higher percentage of aerial challenges (77±17.5%) and tackles (65±32%) won, as well as number of crosses, passes and dribbles were characterized in home performances. Such had already been previously confirmed by several authors who investigated the forementioned in its infancy (Nevill et al., 1996; Sasaki, Nevill and Reilly, 1999), however they also found that teams playing against opposition of a higher quality performed less shots on target, whilst against teams of lower quality were able to complete more dribbles, challenges, and crosses successfully. Although such contextual variables should be considered as they most likely will have an impact on match outcome, analysing such in isolation remains important to further the understanding of the role they can play in goals for and against. As it has always been believed that actions and behaviours relating to technical performance have always had a greater pertinence in goals and goal-scoring opportunities (Hook and Hughes, 2001; Pettit and Hughes, 2001) the present study aimed to see if this remained true and if so, to what extent.

In the modern game it is accepted that tackles, dribbles, and aerial challenges are closely related to match outcome (Modric et al., 2019). Although in the present study the studied team was observed to win/complete a higher percentage of aerial duels, dribbles, and tackles in more favourable outcomes, this shift in notion is rejected as these were not statistically significant. Recent work completed by Yang and colleagues (2018) found that teams of a better league ranking in the Chinese super league won more 50-50 challenges both aerially and on the ground. Such is an indication that a player's better positioning on the pitch and being assertive when out of possession may relate to a positive scoring style of play. The present investigation challenges this narrative however, as in regard to percentage of aerial duels won, percentage of tackles won, and percentage of dribbles completed no statistically significant differences were observed between the 5-minutes preceding a scored goal and the full-match data. Such findings instead agree with the notion that skill-related activities have no influence on goal-scoring and attacking playing styles. It also argues that teams who regain the ball higher on the pitch through successful tackles are no more likely to score, but instead are more likely to enter the opponent's penalty area or take a shot on goal. This supports the idea that completing a greater number of dribbles has no influence on goal-scoring, whereby it is instead likely to contribute to more score-box possessions or crossing opportunities due to the fact the player can more easily move into the space afforded ahead of them after successfully taking the ball past an opponent. This observation highlights the inherent variability of football as a sport, where each scenario [resents unique circumstances and outcomes. For instance, a completed aerial challenge, tackle, or dribble can on some occasions lead to an attack, and on others see the ball go out of play. In regard to goal-conceding, the present investigation found no statistically significant differences in the 5-minutes preceding a conceded goal and the full-match data for the percentage of dribbles completed and aerial duels won, however the opposite was observed for the percentage of tackles won. This finding argues that tacking success is a key indicator of effective defensive performance, a skill-related action that prevents the opposition reaching the 18-yard box and perhaps more importantly, directly averts goal-scoring opportunities against. The present study does not support findings from Gomez and colleagues (2012) who found that teams tackling success in LaLiga contributed to attacks via long possessions which penetrated into the final third which consequently increased a team's shots, not goals. The present results showed that 100% of conceded goals could be correctly predicted at a threshold of 44.6% of successful tackles, with an accuracy of 73% (Figure 17). This adds to existing knowledge that has found possession regains in varying areas of the pitch are paramount to dominant performance (Yang et al., 2018; Fernandez-Navarro et al., 2016). The ability of a football team to recover the ball in the defensive third of the pitch has been seen to be key in organising an attack against a disrupted defensive line. Tackling success is indicative then of a team's assertiveness, where a lower percentage of tackles won often causes goals to be conceded – this further adds to the idea that teams of more successful teams commit more fouls (Liu et al., 2015; Yang et al., 2018; Taylor et al., 2008). This is further in agreement with the narrative that a team who loses more 50-50 challenges are more likely to lose a match (Liu et al., 2016), with the present investigation uncovering significant differences between averages of tackling success for matches won and lost. These findings suggest that regaining possession of the ball through successful tackling contributes to less conceded goals, whilst dribble completion rates and aerial challenge success is more representative of losses in possession and less controlled playing styles. This identification of patterns in performance that ultimately lead to teams scoring or conceding goals reveal strategic approaches that can enhance overall success in football. The present findings pave the way for future research to be directed towards the exploration of a team's effectiveness in regaining possession, whereby introducing training interventions focused on improving tackling will be the ultimate indicator as to whether improved aspects of defensive performance leads to less conceded goals.

Physical Performance

In the modern game, team and player physical performance is at the forefront of analysis methods for underpinning given reasons for certain outcomes, in-game events, and goals. Not only does such information help to uncover given effects of exercise that impact both individual and team performance, such as that of fatigue, but also pinpoint the effectiveness of certain shapes, systems and tactics coaches employ. Football is an open sport, consisting of unpredictable movement patterns. Players are expected to perform skill-based activities at maximal or near-maximal efforts in varying directions and durations. Throughout 90-minute match athletes repeated sprint ability is constantly challenged due to the fact energy in football is predominantly generated aerobically, however the average intensity exceeds anaerobic thresholds which depletes muscle glycogen more rapidly (Krustrup et al., 2005; Aziz et al., 2008). These facts see football teams across all levels of competition use GPS technology to manage, analyse and facilitate performance in the face of fatigue, using the data to better prepare players via correct periodization and load management (Dalen et al., 2016). The collection and analysis of physical performance data from football players Is essential for appropriate post-match recovery strategies. Moreover, there is significant discourse surrounding the potential advantages of utilizing such data to identify the underlying factors contributing to specific match outcomes. The present investigation aimed to coincide with existing knowledge in the current literature to identify key physical indicators that relate to result, but more importantly pave the way in identifying aspects that have a higher probability toward scoring and conceding goals.

Total distance is a simple yet key component of physical performance that is often relative to certain positions, formations, and systems. It can provide insight into the effectiveness of a team's movement which, for instance, can offer justifications toward whether a change in strategy was successful. It is also an indicator that can be analysed match-by-match, helping to highlight any players who may be suffering from fatigue or injury if a given player, or positional group is seen to cover less distance. Carling et al. (2008) observed players in the English Premier League to commonly cover 10-12km on average per game. The present investigation found the studied team to cover 9.5±0.8km on average per game (Tables 2.6-2.8), where it is believed the discrepancies between the competition level, and in turn differences in player training status is a fundamental reason as to why the investigated team covered less total distance. As mentioned in previous sections, total distance can be stratified into distances covered at varying intensities and speed thresholds. During matches, sprints take place every 90 seconds and last 2-4 seconds, whereby Spencer et al. (2005) quantified sprints represent 1-11% of the total distance covered by players, translating to 0.5-3% of the overall match. The present investigation saw the studied team across the 10 analysed matches on average covered 8% of total distance through sprinting. Total sprint distance remains an important physical parameter, with Yang and colleagues (2018) finding significantly greater outputs of sprint total distance for the most successful teams in the Chinese Super League. The present investigation showed that the studied team had higher averages of sprint total distance in matches they won compared to those they drew and lost (945.8±158.9m, 836.6±134.8m, 691.6±168.5m, respectively) which was seen to be significant. This provides further supporting evidence towards the importance of sprinting as an indicator of tactical teamwork, as movement in excess of 7m/s will aid in closing down space more quickly when possession of the ball is lost, where more often than not players will arrive at the ball more quickly than rival players in 50-50 situations (Yang et al., 2018). Sprinting has previously been found to diversify attacking opportunities, opening spaces for penetrative passes to maximise 1-on-1 situations (Gomez, Gomez-Lopez, Lago and Sampaio, 2012). Di Salvo and Colleagues (2009) also found sprint distance to be a key action contributing to goal-scoring opportunities and potential goals across several European leagues, however the present investigation observed no statistically significant differences between team total sprint distance in the 5-minutes preceding a scored goal and the full-match data. The current findings instead suggest that sprint distance is important in facilitating technical indicators that aid in the creation of goal-scoring opportunities, such as entries into the penalty area, but has no sole impact on scoring goals themselves.

One of the most important findings from the present study is that the number of sprints performed in the 5-minutes preceding a conceded goal elicited statistically significant differences from the full-match data (Figures 12-13). This finding is somewhat novel due to the fact Faude, Koch and Meyer (2012) identified the importance of sprinting during goal-scoring actions, naming linear sprints as the most frequent high-intensity activity preceding goals. Research agrees high-intensity actions such as sprints are decisive actions in offensive situations, whereby an attacker can move freely past an opposing defender whilst sprinting to reach space more quickly to shoot at goal, however the present findings suggest this is just as important in order to prevent goals from being conceded (Fernandez-Navarro et al., 2016; Zhou et al., 2021). From a performance perspective, this suggests that when defending, players need to move at maximal velocity, whereby doing so they can perform more interceptions and close down more space to limit the attacking options of opposition teams (Modric et al., 2019). If a player was to move at a jogging pace it is more likely they will fail to track their opponent when they move into space away from the player in possession of the ball tin order to create a chance, offering more opportunities for more score-box possessions and take more shots at goal. This provides strong argument that sprinting holds weight in both offensive and defensive playing styles, where as soon as an attack breaks down players need to move quickly instead of lethargically to maximise the opportunities of averting goals against (Tierney et al., 2016). These findings provide coaches with good evidence to utilise sprinting in fitness testing and training drills across all positions in order to ensure the whole team is capable of reacting quickly to opponent behaviour when put under pressure.

The key component to most GPS analysis from a performance standpoint is perhaps intensity, the more often a player or team can move at high intensity the more space that can be closed down and the faster a loose ball can be reached to regain possession, all of which affords opponents less space and options in possession of the ball (Sculze, Julian and Meyer, 2021). The present study analysed the mentioned physical key performance indicators for the 5-minutes in which the ball was in-play before a goal was scored and conceded, however in football it has been seen that physical distribution in and out of possession influences match outcomes far more (Mernagh et al., 2021). Zhou and colleagues (2021) saw that in the Chinese Super League winning probability was increased when teams covered more distance at high intensity out of possession compared to in possession ($p<0.05$). High-intensity distance covered when out of possession is certainly a proactive defensive strategy in regard to pressing the opposition higher up the pitch (Almeida, Ferreira and Vollosovitch, 2014; Vogelbein, Nopp and Hökelmann 2014). Although this contextual factor was not directly measured in the present investigation it remains intriguing that more high-intensity distance was covered on average in matches the studied team won compared to those they lost but not in total - this wasn’t seen to be significant. Researchers have suggested that distances covered at high intensity is a valid measure of physical football performance due to its strong relationship with training status (Bradley, Mascio, Peart, Olsen and Sheldon, 2010; Krustrup et al., 2003; Krustrup et al., 2005). The present study observed no statistically significant differences between the team high-intensity distance covered in the 5-minutes preceding a goal scored as well as goals conceded and the respective full-match data. There are several authors (Bradley et al., 20211; Tierney et al., 2016; Borghi et al., 2021) that have explored physical outputs specifically to position, it would see reasonable to suggest that given aspects of physical performance, such as high-intensity distance covered would be higher for players who are involved more with offensive play (forwards, wide defenders) than those concerned with defensive play (central defenders).

Modric and Colleagues (2019) analysed associations between game performance indicators and running behaviours across playing positions in the 2018/19 Croatian Soccer League. These authors found strong correlations between forwards sprint total distance and technical performance, deeming it a highly important physical determinant for success in this position. The present investigation observed statistically significant differences in a forward's sprint total distance outputs in the 5 minutes preceding a goal scored and the full-match equivalents (Figure 18). A forward's sprint distance was significantly higher in the 5 minutes that led up to a goal, whereby at a threshold of 43.9m of sprint distance per minute 64.3% of goals could be correctly predicted with an accuracy of 82% (Figure 19). This builds on the knowledge provided by Modric et al. (2019), where for forwards every sprint provides a great opportunity to perform attacking actions such as explosive bursts into an opponent's penalty area to meet a cross and take a shot at goal. This further interlinks with the previous finding that forwards perform the lowest number of tackles, interceptions, and clearances (Yi et al., 2018), whereby their absence in regaining possession of the ball and focus on dribbling the ball into the most threatening areas of the pitch sees them cover more distance whilst sprinting. The current finding stresses the importance of a forward's sprint ability for coaches and practitioners, focusing on this physical aspect in this position can heighten the number of attacking situations that are created as sprinting into space offers more passing options to players than have come into play – increasing the likelihood of positive game outcomes (Liu et al., 2015). Interestingly, statistically significant differences were observed for the sprint total distance covered by forwards in the 5-minutes preceding a conceded goal and the full-match data. At a threshold of 40.4m total sprint distance per minute 41.7% of conceded goals could be correctly predicted at an accuracy of 71%. This draws in the idea that a forward's sprinting capacity is not only beneficial for attacking play, but also for defensive resilience to prevent the opportunities afforded to opposing players by moving back into position quickly. Modric et al. (2019) observed forwards to complete the least amount of distance at walking and jogging intensities, which aligns further with the strategy of 'defending from the front'. If forwards are more able to sprint to close down space when defending, it limits the passing options for rival players in their defensive third – this would not be possible if forwards moved at low-intensity. Coaches should look to ensure forwards understand the importance of not becoming lethargic both in and out of possession, as this can provide success at both ends of the pitch for scoring more goals and seeing less goals being conceded.

Midfield players have a responsibility in providing balance and stability between the forwards and defenders, facilitating attacks through quality ball control and a variety of passes (Yi et al., 2018) and tracking back into the defensive third to aid in regaining custody of the ball. Midfield players have been found to have higher oxygen uptakes compared to other outfield positions (Bangsbo and Michalsik, 2002), whereby their superior VO_{2Max} values sees them have a higher high intensity running profile and endurance capacity. Bradley et al. (2010) found that distances covered at high intensity were highest for midfielders when compared across other playing positions. The present investigation also found midfielders to cover the greatest distance at high intensity both in total and average compared to other positions across all matches analysed (25,587.5±764.9m, 1303.4±191.6m, respectively). The ability to perform repeated bouts of high-speed running has previously been deemed as a key characteristic to performing at an elite level in football, regardless of position (Drust, Atkinson and Reilly, 2007), however it has previously been found to have no significant association with technical performance of midfielders (Modric et al., 2019). It has been argued that success for midfielders is via ball possession, key passes, dribbles completed and shots, but the present investigation conflicts such an ideology. Statistically significant differences for high-intensity distance covered by midfielders were observed between both the 5-minutes preceding a goal scored as well as conceded and the equivalent full-match data. This agrees with the idea that an increased distance covered at high intensity covered in the minute prior to an attempt on goal is positively related to success (Schulze et al., 2021). It seems that a midfielders tactical role sees them cover more distance at high intensity, but it is important for them to do so in order to press the opposition in the most central areas of the pitch. Not only this, but it is generally accepted that low-intensity activities are not crucial, nor have any effect on soccer performance (Di Salvo et al., 2009), therefore distance covered at high-intensity is a key variable for midfielders which can facilitate their ability to win more duels and challenges when out of possession, and initiate attacks by carrying the ball up the pitch more quickly. It must be noted that this finding may be a cause and effect of the given formation the studied team performed in due to the fact the coach utilised a 4-3-3 formation. Previous research has found the number of high-intensity actions and distances are greater in this formation than defensive equivalents like 4-5-1 (Bradley et al., 2011). This is likely a cause of the offensive and defensive characteristics as 4-3-3 reinforces the midfield zones in expense of an extra forward player. Therefore, in a 4-3-3 system greater reliance is put on the midfield to cover space and reach opposing players more quickly to shut down passing channels, forcing them to work harder. Similarly, Tierney and colleagues (2016) saw midfielders cover greater metabolic load distances in a 4-3-3 system, further impacting the midfields match demands due to its attacking set-up.

Wide defenders are defensive players whose starting position on a football pitch is in the defensive third, however the role is predominantly focused on aiding attacks and operating high in the midfield and final thirds of the pitch. In order to do so they have to move away from their deep starting position, getting out of the defensive third to carry the ball into more threatening areas to generate crossing opportunities and score-box possessions to create chances for teammates. Their operation in wide areas of the pitch is often utilised by coaches to stretch the opposition, and in 4-3-3 systems have been seen to complete more high-speed running than central defenders (Tierney et al., 2016; Borghi et al., 2021). Research completed by Bradley and colleagues (2010) found players in wide positions sprinted longer distances compared with centrally positioned equivalents, with the present study also observing wide defenders to cover more sprint distance on average than central defenders (782.7±76.1m, 645.6±164m, respectively). It is likely the more space that is afforded to wide defenders makes these areas of the pitch more accessible to run into at high-speed. A wide defender's tactical role of aiding in both defensive and offensive phases of play further elevate their sprint count (Di Salvo et al., 2010), where the present study saw wide defenders complete a greater total number of sprints when compared to central equivalents (183.4±1.5, 174.1±3.5, respectively). Sprinting frequency has therefore been deemed an important aspect of a full-backs physical performance, however the present study found no statistically significant differences between the wide-defenders sprint count in the 5-minutes preceding a goal scored and the full-match data; instead, statistically significant differences were observed for wide defender's sprint count in the 5-minutes leading up to a goal conceded. At a threshold of 1.14 sprints, 58.3% of goals conceded can be predicted with an accuracy of 79% accuracy (Figure 23). This suggests that sprinting may be the difference in being able to intercept passes and stop an opponent from crossing into the box. Players who are positioned wide more often have the space in front of them to reach sprinting velocities, whereas central equivalents do not (Varley et al., 2013; Dalen et al., 2016). Such provides good justifications as to why central defenders in the present study were seen cover the least amount of distance at high intensity, as well as less frequently complete sprints (Table 6.9 and 7.1). Furthermore, no statistically significant differences were observed for central defender's total distance covered in the 5-minutes preceding a scored as well as a conceded goal when compared with the full-match data. This is in alignment with previous authors who have suggested central defenders cover the shortest distances whilst running (Mallo et al., 2015; Dellal et al., 2011; Bradley et al., 2009) as their technical roles are reliant on reactions and skill, not speed. (i.e., aerial duels, tackles, positioning and interceptions). Central defenders' performance is characterised by travelling little distance (Borghi et al., 2021), where the present findings reinforce to practitioners that reliance is instead on power and strength to enhance their ability to repeatably perform defensive actions. Regardless of the distance a central defender has to cover, the present investigation suggests this has no effect on scoring or conceding during a match, where instead wide defenders can be a catalyst in the creation of opportunities for and prevention of opportunities against.

Limitations

The present study was completed on only one team in the selected league, whereby conclusions are based on a limited sample of matches. It would be of interest to future researchers top identify whether similar findings would be similar in other teams competing within the studied league – certainly those who employ different shapes, systems, and strategy (i.e., 5 defenders). Future research always has a pathway of looking at this on a bigger scale, looking at these aspects of performance throughout an entire season. Such would help to bring about a wider wealth of results more strongly confirming technical and physical performance indicators relative to a team's contribution to goal-scoring and conceding. As an example, no goals were recorded in this present study from outside the penalty area, these may be rarer occurrences, but were not captured by the current study.

What must be considered however to achieve this is that of resource. Future research that looks to obtain this data in real-time during matches, working with systems that increase data availability and reduce the time taken for analysis may be the ultimate requirement. Researching long-term influences on technical and physical performance would perhaps benefit from having greater number of cameras as well; to help increase data quality and minimise human error during data collection protocols via more angles and viewpoints to better watch, replay and validate match events (Willmont, 2016). Within the potential scope for studies like this thesis to be taken further, the difficulties of integrating different technologies as well as the implications associated with resources clouds the possibilities of catering for a bigger sample of matches and/or teams.

Future studies may also look to include and account for the impact of pitch surface (grass vs. artificial turf), as in the present study both surfaces were included within the sample. Research that is able to keep consistency in regard to pitch surface may help to contribute to more holistic knowledge of the advantages, if any, of any pitch surface I the modern game or at this level of competition. As too in the discussion, the comparison of the present results with similar findings from leagues across the globe at varying levels of competition sees a need for a level of caution in interpretation. Throughout the literature there is a strong belief amongst authors that the theory is likely to be applicable regardless of playing level, however future research should be aware of the potential discrepancies that remain when comparing sub-elite performance data against elite professionals (Bangsbo et al., 2006; Di Salvo et al., 2007; Hill-Haas et al., 2011). The same applies in the interpretation of statistical results from ROC analysis in the present thesis, whereby the higher percentages of false predictions and in turn error rates argue the data’s clarity.

There is no doubt that an array of contextual factors to consider in football performance analysis, including home and away performances, match status and even the effects of score-line. Each will have their own impact on results, as too will the complete random nature of the sport; nevertheless, the present study strongly helps to broaden the currently limited knowledge into causes of goal-scoring and conceding, helping to underpin aspects of performance that are of greatest interest to analysts, coaches, and practitioners to strengthening offensive and defensive performances.

5 - CONCLUSION AND PRACTICAL APPLICATIONS

The purpose of this thesis was to investigate key aspects of football performance that may predict goal outcomes. Current research in this area of physical and technical game performance have looked at these aspects in relation to successful teams, results, and goals themselves. However, the present investigation looked to build on current knowledge concerning how successful and unsuccessful events take place throughout football matches via analysing team outputs in a relative period as close to goal events both for and against – to feed out critical aspects of successful attacking as well as unsuccessful defensive play. Results of the present study have identified the studied team’s number of passes, forward passes, entries into the box for and percentage of shots on target had a direct impact upon their goal-scoring, making these the most prominent aspects of attacking play that led to success in the 5-minutes preceding a goal event. More novel findings saw that the studied teams were deemed to have stronger defensive performances via higher percentages of passing accuracy, crossing accuracy and the number of entries into the penalty area for and against; whilst team sprint count and tackling success were also parameters that held significant differences in the 5-minutes preceding a conceded goal when compared with the full 90-minute equivalents. These findings meet the studies aims of going beyond what contributes to winning and losing, instead highlighting how these match performance indicators are seen to contribute to positive and negative match events, and perhaps more importantly, to what predictive threshold.

Another aim of the present study was to incorporate physical data and stratify such by position, to recognise what aspects of physical performance are pertinent to playing position and in turn, team outcomes. To the best of the authors knowledge, this is the first study of its kind to identify KPI’s relative to playing position that have an impact on goal-scoring and goal-conceding. The present study confirmed the significant differences in forwards sprint distance for both scored and conceded goals; midfielders high-intensity distance covered for both scored and conceded goals and wide defenders sprint count for conceded goals when compared against the full 90-minute data. Such findings aim to contribute to medical, coaching and recruitment professionals’ knowledge through a different perspective, whereby relative, real-time statistical thresholds clearly identify physical player attributes that are most likely to bring about more success for a given team at both ends of the football pitch.

The statistical analysis methods used in the present study enabled us to highlight given thresholds of physical and technical outputs to strengthen our findings for coaches, objectively identifying to them to what extent goal-scoring can be facilitated, and goal-conceding prevented. Although these findings may enable coaches to use more focused training drills relevant to the significant KPI’s identified in this study, it must be noted that future studies use of an intervention that measures an improvement in any given parameter, and whether this truly provides a relationship between enhanced goal-scoring or goal-conceding may be the gold standard (i.e., tackling success). Nonetheless, the present results and discussion provide strong argument for improved tactical decision-making and player selection for managers of the game.

REFERENCE LIST

Abbott, W., Brickley, G. and Smeeton, N.J. (2018). 'Positional differences in GPS outputs and perceived exertion during soccer training games and competition'. The Journal of Strength & Conditioning Research, 32(11), pp.3222-3231.

Acar, M.F., Yapicioglu, B., Arikan, N., Yalcin, S., Ates, N. and Ergun, M. (2008). Analysis of goals scored in the 2006 World Cup. In Science and football VI (pp. 261-268). Routledge.

Akenhead, R., Hayes, P.R., Thompson, K.G. and French, D. (2013). 'Diminutions of acceleration and deceleration output during professional football match play'. Journal of science and medicine in sport, 16(6), pp.556-561.

Almeida, C.H., Ferreira, A.P. and Volossovitch, A., 2014. Effects of match location, match status and quality of opposition on regaining possession in UEFA Champions League. Journal of human kinetics, 41, p.203.

Andrzejewski, M., Chmura, J., Strzelczyk, R. and Konarski, J. (2009). 'Individualization of physical loads and speed abilities of young soccer players in a six-month training macrocycle'. Journal of human kinetics, 22(1), pp.35-42.

Andrzejewski, M., Chmura, P., Konefał, M., Kowalczuk, E. and Chmura, J. (2017). 'Match outcome and sprinting activities in match play by elite German soccer players'. The Journal of Sports Medicine and Physical Fitness, 58(6), pp.785-792.

Aquino, R., Vieira, L.H.P., Carling, C., Martins, G.H., Alves, I.S. and Puggina, E.F. (2017). 'Effects of competitive standard, team formation and playing position on match running performance of Brazilian professional soccer players'. International Journal of Performance Analysis in Sport, 17(5), pp.695-705.

Armatas, V., Ampatis, D., Yiannakos, A. (2005). 'Comparison of the effectiveness between counter-attacks and organized offences in Champions League 2002-03'. 1o International Scientific Congress in Soccer, 8-10 April, Trikala, Greece.

Armatas, V., Yiannakos, A., Papadopoulou, S. and Skoufas, D. (2009). 'Evaluation of goals scored in top ranking soccer matches: Greek "Super League" 2006-07'. Serbian Journal of Sports Sciences, 3(1), pp.39-43.

Asian Clemente, J.A., Requena, B., Jukic, I., Nayler, J., Hernández, A.S. and Carling, C. (2019). 'Is physical performance a differentiating element between more or less successful football teams?'. Sports, 7(10), p.216.

Austin, D.J. and Kelly, S.J. (2014). 'Professional rugby league positional match-play analysis through the use of global positioning system'. The Journal of Strength & Conditioning Research, 28(1), pp.187-193.

Aziz, A.R., Mukherjee, S., Chia, M.Y.H. and Teh, K.C. (2008). 'Validity of the running repeated sprint ability test among playing positions and level of competitiveness in trained soccer players'. International journal of sports medicine, 29(10), pp.833-838.
Baker, S.W. (1989). 'Soil physical conditions of the root zone layer and the performance of winter games' pitches'. Soil use and management, 5(3), pp.116-122.

Bangsbo, J. and Peitersen, B. (2000). Soccer systems and strategies. Human Kinetics.

Bangsbo, J. and Michalsik, L., (2002). Assessment of the physiological capacity of elite soccer players. Science and football IV, pp.53-62.

Bangsbo, J., Mohr, M. and Krustrup, P. (2006). 'Physical and metabolic demands of training and match-play in the elite football player'. Journal of sports sciences, 24(07), pp.665-674.

Barbero-Álvarez, J.C., Coutts, A., Granda, J., Barbero-Álvarez, V. and Castagna, C. (2010). 'The validity and reliability of a global positioning satellite system device to assess speed and repeated sprint ability (RSA) in athletes'. Journal of science and medicine in sport, 13(2), pp.232-235.

Barnes, C., Archer, D.T., Hogg, B., Bush, M. and Bradley, P. (2014). 'The evolution of physical and technical performance parameters in the English Premier League'. International journal of sports medicine, 35(13), pp.1095-1100.

Barnett, V. and Hilditch, S. (1993). 'The effect of an artificial pitch surface on home team performance in football (soccer)'. Journal of the Royal Statistical Society: Series A (Statistics in Society), 156(1), pp.39-50.

Bauer, G. (1993). Soccer Techniques, Tactics and Teamwork. Sterling publishing Company.

Bergier, J., Soroka, A. and Buraczewski, T. (2008). Analysis of actions ending with shots at goal in the Women's European Football Championship (England 2005). In Science and Football VI (pp. 223-227). Routledge.

Bloomfield, J., Polman, R. and O'Donoghue, P. (2007). 'Physical demands of different positions in FA Premier League soccer'. Journal of sports science & medicine, 6(1), p.63.

Borghi, S., Colombo, D., La Torre, A., Banfi, G., Bonato, M. and Vitale, J.A. (2021). 'Differences in GPS variables according to playing formations and playing positions in U19 male soccer players'. Research in Sports Medicine, 29(3), pp.225-239.

Bradley, P.S., Carling, C., Archer, D., Roberts, J., Dodds, A., Di Mascio, M., Paul, D., Gomez Diaz, A., Peart, D. and Krustrup, P. (2011). 'The effect of playing formation on high-intensity running and technical profiles in English FA Premier League soccer matches'. Journal of sports sciences, 29(8), pp.821-830.

Bradley, P.S., Di Mascio, M., Peart, D., Olsen, P. and Sheldon, B. (2010). 'High-intensity activity profiles of elite soccer players at different performance levels'. The journal of strength & conditioning research, 24(9), pp.2343-2351.

Bradley, P.S., Lago-Peñas, C., Rey, E. and Gomez Diaz, A. (2013). 'The effect of high and low percentage ball possession on physical and technical profiles in English FA Premier League soccer matches'. Journal of sports sciences, 31(12), pp.1261-1270.

Buchheit, M., Allen, A., Poon, T.K., Modonutti, M., Gregson, W. and Di Salvo, V. (2014). 'Integrating different tracking systems in football: multiple camera semi-automatic system, local position measurement and GPS technologies'. Journal of sports sciences, 32(20), pp.1844-1857.

Canton, A., Torrents, C., Ric, A., Gonçalves, B., Sampaio, J. and Hristovski, R. (2019). 'Effects of temporary numerical imbalances on collective exploratory behavior of young and professional football players'. Frontiers in psychology, p.1968.

Carling, C. (2011). 'Influence of opposition team formation on physical and skill-related performance in a professional soccer team'. European Journal of Sport Science, 11(3), pp.155-164.

Carling, C. and Dupont, G. (2011). 'Are declines in physical performance associated with a reduction in skill-related performance during professional soccer match-play?'. Journal of sports sciences, 29(1), pp.63-71.

Carling, C., Bloomfield, J., Nelsen, L. and Reilly, T. (2008). 'The role of motion analysis in elite soccer'. Sports medicine, 38(10), pp.839-862.

Carling, C., Williams, A.M. and Reilly, T. (2007). Handbook of soccer match analysis: A systematic approach to improving performance. Routledge.

Castellano, J., Blanco-Villaseñor, A. and Alvarez, D. (2011). 'Contextual variables and time-motion analysis in soccer'. International journal of sports medicine, 32(06), pp.415-421.

Castellano, J., Casamichana, D. and Lago, C. (2012). 'The use of match statistics that discriminate between successful and unsuccessful soccer teams'. Journal of human kinetics, 31, p.139.

Chalcraft, T. (2012). Historical Dictionary of Soccer. Reference Reviews.

Chmura, P., Andrzejewski, M., Konefał, M., Mroczek, D., Rokita, A. and Chmura, J. (2017). 'Analysis of motor activities of professional soccer players during the 2014 World Cup in Brazil'. Journal of Human Kinetics, 56(1), pp.187-195.

Collet, C. (2013). 'The possession game? A comparative analysis of ball retention and team success in European and international football, 2007–2010'. Journal of sports sciences, 31(2), pp.123-136.

Cometti, G., Maffiuletti, N.A., Pousson, M., Chatard, J.C. and Maffulli, N. (2001). 'Isokinetic strength and anaerobic power of elite, subelite and amateur French soccer players'. International journal of sports medicine, 22(01), pp.45-51.

Coutts, A.J. and Duffield, R. (2010). 'Validity and reliability of GPS devices for measuring movement demands of team sports'. Journal of science and Medicine in Sport, 13(1), pp.133-135.

Coutts, A.J., Rampinini, E., Marcora, S.M., Castagna, C. and Impellizzeri, F.M. (2009). 'Heart rate and blood lactate correlates of perceived exertion during small-sided soccer games'. Journal of science and medicine in sport, 12(1), pp.79-84.

Cummins, C., Orr, R., O'Connor, H. and West, C. (2013) 'Global positioning systems (GPS) and microtechnology sensors in team sports: a systematic review'. Sports medicine, 43(10), pp.1025-1042.

Dalen, T., Jørgen, I., Gertjan, E., Havard, H.G. and Ulrik, W. (2016) 'Player load, acceleration, and deceleration during forty-five competitive matches of elite soccer'. The Journal of Strength & Conditioning Research, 30(2), pp.351-359.

Delgado-Bordonau, J.L., Domenech Monforte, C., Guzmán Luján, J.F. and Méndez Villanueva, A. (2013). 'Offensive and defensive team performance: relation to successful and unsuccessful participation in the 2010 Soccer World Cup'.

Dellal, A., Chamari, K., Wong, D.P., Ahmaidi, S., Keller, D., Barros, R., Bisciotti, G.N. and Carling, C. (2011). 'Comparison of physical and technical performance in European soccer match-play: FA Premier League and La Liga'. European journal of sport science, 11(1), pp.51-59.

Dellal, A., Wong, D.P., Moalla, W. and Chamari, K. (2010). Physical and technical activity of soccer players in the French First League-with special reference to their playing position. International SportMed Journal, 11(2), pp.278-290.

Di Salvo, V., Baron, R., Tschan, H., Calderon Montero, F.J., Bachl, N., & Pigozzi, F. (2007). 'Performance characteristics according to playing position in elite soccer'. International Journal of Sports Medicine, 28, 222–227.

Di Salvo, V., Gregson, W., Atkinson, G., Tordoff, P. and Drust, B. (2009). 'Analysis of high intensity activity in Premier League soccer'. International journal of sports medicine, 30(03), pp.205-212.

Drust, B., Atkinson, G. and Reilly, T. (2007). 'Future perspectives in the evaluation of the physiological demands of soccer'. Sports medicine, 37(9), pp.783-805.

Duffield, R., Reid, M., Baker, J. and Spratford, W. (2010). 'Accuracy and reliability of GPS devices for measurement of movement patterns in confined spaces for court-based sports'. Journal of science and medicine in sport, 13(5), pp.523-525.

Dupont, G., Akakpo, K. and Berthoin, S. (2004). 'The effect of in-season, high-intensity interval training in soccer players'. The Journal of Strength & Conditioning Research, 18(3), pp.584-589.

Duthie, G., Pyne, D. and Hooper, S. (2005). 'Time motion analysis of 2001 and 2002 super 12 rugby'. Journal of sports sciences, 23(5), pp.523-530.

Dwyer, D.B. and Gabbett, T.J. (2012). 'Global positioning system data analysis: Velocity ranges and a new definition of sprinting for field sport athletes'. The Journal of Strength & Conditioning Research, 26(3), pp.818-824.

Ensum, J., Pollard, R. and Taylor, S. (2005), May. Applications of logistic regression to shots at goal at association football. In Science and football V: the proceedings of the Fifth World Congress on Science and Football (p. 214).

Evangelos, B., Eleftherios, M., Aris, S., Ioannis, G., Aristotelis, G. and Antonios, S. (2013). 'Offense and defensive statistical indicators that determine the Greek Superleague teams placement on the table 2011-12'. Journal of Physical Education and Sport, 13(3), p.338.

Faude, O., Koch, T. and Meyer, T. (2012). 'Straight sprinting is the most frequent action in goal situations in professional football'. Journal of sports sciences, 30(7), pp.625-631.

Fernandez-Navarro, J., Fradua, L., Zubillaga, A., Ford, P.R. and McRobert, A.P. (2016). 'Attacking and defensive styles of play in soccer: analysis of Spanish and English elite teams'. Journal of sports sciences, 34(24), pp.2195-2204.

FIFA (2015). Available at: https://www.fifa.com/2015

Filetti, C., Ruscello, B., D'Ottavio, S. and Fanelli, V. (2017). 'A study of relationships among technical, tactical, physical parameters and final outcomes in elite soccer matches as analyzed by a semiautomatic video tracking system'. Perceptual and Motor Skills, 124(3), pp.601-620.

Franks, I.M. and Miller, G. (1991). ;Training coaches to observe and remember'. Journal of sports sciences, 9(3), pp.285-297.

Fransson, D., Krustrup, P. and Mohr, M. (2017). 'Running intensity fluctuations indicate temporary performance decrement in top-class football'. Science and Medicine in Football, 1(1), pp.10-17.

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).

Gomez-Piqueras, P., Gonzalez-Villora, S., Castellano, J. and Teoldo, I. (2019). 'Relation between the physical demands and success in professional soccer players'

Gómez, M.A., Gómez-Lopez, M., Lago, C. and Sampaio, J. (2012). 'Effects of game location and final outcome on game-related statistics in each zone of the pitch in professional football'. European Journal of Sport Science, 12(5), pp.393-398.

González-Víllora, S., Serra-Olivares, J., Pastor-Vicedo, J.C. and Da Costa, I.T. (2015) 'Review of the tactical evaluation tools for youth players, assessing the tactics in team sports: football'. Springerplus, 4(1), pp.1-17.

Grant A.G., Williams A.M., Reilly T. (1999). 'Analysis of the goals scored in the 1998 World Cup'. Journal of Sports Sciences 17, 826-827.

Groom, R. and Cushion, C.H.R.I.S. (2004). 'Coaches perceptions of the use of video analysis: A case study'. Insight, 7(3), pp.56-58.

Groom, R., Cushion, C. and Nelson, L. (2011). 'The delivery of video-based performance analysis by England youth soccer coaches: towards a grounded theory'. Journal of applied sport psychology, 23(1), pp.16-32.

Guttman, A. (2012). From ritual to record: The nature of modern sport. Columbia University Press

Harrop, K. and Nevill, A. (2014). 'Performance indicators that predict success in an English professional League One soccer team'. International Journal of Performance Analysis in Sport, 14(3), pp.907-920.

Hill-Haas, S.V., Dawson, B., Impellizzeri, F.M. and Coutts, A.J. (2011). 'Physiology of small-sided games training in football: a systematic review'. Sports medicine, 41, pp.199-220.

Hook C., and Hughes M. (2001). Patterns of play leading to shots in Euro 2000. In M Hughes, I Franks (eds): Pass.Com. Cardiff: Center for Performance Analysis, UWIC, 2001, pp 295-302.

Hopkins, O. (2022). How Does the Style of Football Change as You Journey Down the English Football League?. Available at: https://theanalyst.com/eu/2022/04/how-does-the-style-of-football-change-as-you-journey-down-the-english-football-league/

Hoppe, M.W., Slomka, M., Baumgart, C., Weber, H. and Freiwald, J. (2015). 'Match running performance and success across a season in German Bundesliga soccer teams'. International journal of sports medicine, 36(07), pp.563-566.

Hughes, M. and Franks, I. (2005). 'Analysis of passing sequences, shots and goals in soccer'. Journal of sports sciences, 23(5), pp.509-514.

Hughes, M., Franks, I.M., Franks, I.M. and Dancs, H. eds. (2019). Essentials of performance analysis in sport. Routledge.

Hughes, M.D. and Bartlett, R.M. (2002). 'The use of performance indicators in performance analysis'. Journal of sports sciences, 20(10), pp.739-754.

Hughes, M.G., Birdsey, L., Meyers, R., Newcombe, D., Oliver, J.L., Smith, P.M., Stembridge, M., Stone, K. and Kerwin, D.G. (2013). 'Effects of playing surface on physiological responses and performance variables in a controlled football simulation'. Journal of Sports Sciences, 31(8), pp.878-886.

Ingebrigtsen, J., Bendiksen, M., Randers, M.B., Castagna, C., Krustrup, P. and Holtermann, A. (2012). 'Yo-Yo IR2 testing of elite and sub-elite soccer players: performance, heart rate response and correlations to other interval tests'. Journal of sports sciences, 30(13), pp.1337-1345.

Janković, A., Leontijević, B., Jelušić, V., Pašić, M. and Mićović, B. (2011). 'Influence of tactics efficiency on results in serbian soccer super league in season 2009/2010'. Journal of Physical Education & Sport/Citius Altius Fortius, 11(1).

Jennings, D., Cormack, S., Coutts, A.J., Boyd, L. and Aughey, R.J. (2010). 'The validity and reliability of GPS units for measuring distance in team sport specific running patterns'. International journal of sports physiology and performance, 5(3), pp.328-341.

Johnston, R.J., Watsford, M.L., Kelly, S.J., Pine, M.J. and Spurrs, R.W. (2014). 'Validity and interunit reliability of 10 Hz and 15 Hz GPS units for assessing athlete movement demands'. The Journal of Strength & Conditioning Research, 28(6), pp.1649-1655.

Johnston, R.J., Watsford, M.L., Pine, M.J., Spurrs, R.W., Murphy, A. and Pruyn, E.C. (2012). 'Movement demands and match performance in professional Australian football'. International journal of sports medicine, 33(02), pp.89-93.

Jones, P.D., James, N. and Mellalieu, S.D. (2004). 'Possession as a performance indicator in soccer'. International Journal of Performance Analysis in Sport, 4(1), pp.98-102.

Kapidžić, A., Mejremić, E., Bilalić, J. and Bečirović, E. (2010). 'Differences In Some Parameters of Situation Efficiency Between Winning And Defeated Teams At Two Levels Of Competition'. Sport Scientific & Practical Aspects, 7(2).

Kelly, V., Scott, M.T. and Scott, T.J. (2014). 'The validity and reliability of global positioning systems in team sport: a brief review'. Journal of Australian Strength and Conditioning, 22(5), pp.186-190.

Kempe, M., Vogelbein, M., Memmert, D. and Nopp, S. (2014). 'Possession vs. direct play: evaluating tactical behavior in elite soccer'. International Journal of Sports Science, 4(6A), pp.35-41.

Kirkendall, D. T. Dowd, W. W. and DiCicco, A. D. (2002) 'Patterns of successful attacks: a comparison of the men's and women's World Cup'. Revista de Fútbol y Ciencia, 1 (1), pp. 29-36.

Krustrup, P., Jones, A.M., Wilkerson, D.P., Calbet, J.A. and Bangsbo, J. (2009). 'Muscular and pulmonary O2 uptake kinetics during moderate-and high-intensity sub-maximal knee-extensor exercise in humans'. The Journal of physiology, 587(8), pp.1843-1856.

Krustrup, P., Mohr, M., Amstrup, T., Rysgaard, T., Johansen, J., Steensberg, A., Pedersen, P.K. and Bangsbo, J. (2003). 'The yo-yo intermittent recovery test: physiological response, reliability, and validity'. Medicine & Science in Sports & Exercise, 35(4), pp.697-705.

Krustrup, P., Mohr, M., Ellingsgaard, H.E.L.G.A. and Bangsbo, J. (2005). 'Physical demands during an elite female soccer game: importance of training status'. Medicine and science in sports and exercise, 37(7), p.1242.

Krustrup, P., Mohr, M., Steensberg, A., Bencke, J., Kjær, M. and Bangsbo, J. (2006). 'Muscle and blood metabolites during a soccer game: implications for sprint performance'. Medicine & Science in Sports & Exercise, 38(6), pp.1165-1174.

Lago-Ballesteros, J. and Lago-Peñas, C. (2010). 'Performance in team sports: Identifying the keys to success in soccer'. Journal of Human kinetics, 25(1), pp.85-91.

Lago-Peñas, C., Acero, RM and Vargas, FS. (2007). Performance in soccer. A modeling of the determining variables for FC Barcelona. notes Physical education and sports , 4 (90), pp.51-58.

Lago-Peñas, C., Lago-Ballesteros, J. and Rey, E. (2011). 'Differences in performance indicators between winning and losing teams in the UEFA Champions League'. Journal of human kinetics, 27(1), pp.135-146.

Lago-Peñas, C., Rey, E. and Lago-Ballesteros, J. (2012). 'The influence of effective playing time on physical demands of elite soccer players'. Open Sports Sci J, 5, pp.188-192.

Lago, C. (2009). 'The influence of match location, quality of opposition, and match status on possession strategies in professional association football'. Journal of sports sciences, 27(13), pp.1463-1469.

Laird, P. and Waters, L. (2008). 'Eyewitness recollection of sport coaches'. International Journal of Performance Analysis in Sport, 8(1), pp.76-84.

Le Gall, F., Carling, C., Williams, M. and Reilly, T. (2010). 'Anthropometric and fitness characteristics of international, professional and amateur male graduate soccer players from an elite youth academy'. Journal of science and medicine in sport, 13(1), pp.90-95.

Lees, A. (2002). 'Technique analysis in sports: a critical review'. Journal of sports sciences, 20(10), pp.813-828.

Leontijević, B., Janković, A. and Tomić, L. (2019). 'Attacking performance profile of football teams in different national leagues according to uefa rankings for club competitions'. Facta Universitatis, Series: Physical Education and Sport, pp.697-708.

Liebermann, D.G., Katz, L., Hughes, M.D., Bartlett, R.M., McClements, J. and Franks, I.M. (2002). 'Advances in the application of information technology to sport performance'. Journal of sports sciences, 20(10), pp.755-769.

Liu, H., Hopkins, W.G. and Gómez, M.A. (2016). 'Modelling relationships between match events and match outcome in elite football'. European journal of sport science, 16(5), pp.516-525.

Lyle, J. (2005). Sports coaching concepts: A framework for coaches' behaviour. Routledge.

Mackenzie, R. and Cushion, C. (2013). 'Performance analysis in football: A critical review and implications for future research'. Journal of sports sciences, 31(6), pp.639-676.

MacLeod, H., Morris, J., Nevill, A. and Sunderland, C. (2009). 'The validity of a non-differential global positioning system for assessing player movement patterns in field hockey'. Journal of sports sciences, 27(2), pp.121-128.

Mallo, J. and Navarro, E. (2008) 'Physical load imposed on soccer players during small-sided training games'. Journal of sports medicine and physical fitness, 48(2), p.166.

Malone, J.J., Di Michele, R., Morgans, R., Burgess, D., Morton, J.P. and Drust, B. (2015). 'Seasonal training-load quantification in elite English premier league soccer players'. International journal of sports physiology and performance, 10(4), pp.489-497.

Mao, L., Peng, Z., Liu, H. and Gómez, M.A. (2016). 'Identifying keys to win in the Chinese professional soccer league'. International Journal of Performance Analysis in Sport, 16(3), pp.935-947.

Martin, L. (2016). Sports performance measurement and analytics: The science of assessing performance, predicting future outcomes, interpreting statistical models, and evaluating the market value of athletes. FT Press.

McGarry, T. (2009). 'Applied and theoretical perspectives of performance analysis in sport: Scientific issues and challenges'. International Journal of Performance Analysis in Sport, 9(1), pp.128-140.

McGarry, T., O'Donoghue, P. and de Eira Sampaio, A.J. eds. (2013). 'Routledge handbook of sports performance analysis'. London, UK:: Routledge.

McGuckin, B., Bradley, J., Hughes, M., O'Donoghue, P. and Martin, D. (2020). 'Determinants of successful possession in elite football'. International Journal of Performance Analysis in Sport, 20(3), pp.420-431.

Mennis, J., Mason, M., Coffman, D.L. and Henry, K. (2018). 'Geographic imputation of missing activity space data from ecological momentary assessment (EMA) GPS positions'. International journal of environmental research and public health, 15(12), p.2740.

Mernagh, D., Weldon, A., Wass, J., Phillips, J., Parmar, N., Waldron, M. and Turner, A. (2021). 'A comparison of match demands using ball-in-play versus whole match data in professional soccer players of the English Championship'. Sports, 9(6), p.76.

Meyer, T. (2006). 'Trainingsgestaltung im Leistungsfußball-wissenschaftliche Erkenntnisse vs. sportartspezifische Tradition'. Deutsche Zeitschrift für Sportmedizin, 57(5).

Michailidis, C., Michailidis, I., Papaiakovou, G. and Papaiakovou, I. (2004). Analysis and evaluation of way and place that goals were achieved during the European Champions League of Football 2002-2003. Sports Organization, 2(1), 48-54.

Modric, T., Versic, S., Sekulic, D. and Liposek, S. (2019). 'Analysis of the association between running performance and game performance indicators in professional soccer players'. International journal of environmental research and public health, 16(20), p.4032.

Mohr, M., Krustrup, P. and Bangsbo, J. (2003). 'Match performance of high-standard soccer players with special reference to development of fatigue'. Journal of sports sciences, 21(7), pp.519-528.

Mohr, M., Krustrup, P. and Bangsbo, J. (2005). 'Fatigue in soccer: a brief review'. Journal of sports sciences, 23(6), pp.593-599.

Mohr, M., Nybo, L., Grantham, J. and Racinais, S. (2012). 'Physiological responses and physical performance during football in the heat'. PloS one, 7(6), p.e39202.

Moniz, F., Scaglia, A., Sarmento, H., García-Calvo, T. and Teoldo, I. (2020). 'Effect of an inside floater on soccer players tactical behaviour in small sided and conditioned games'. Journal of Human Kinetics, 71(1), pp.167-177.

Murray, B. and Murray, W.J. (1998). The world's game: a history of soccer (Vol. 14). University of Illinois Press.

Nevill, A., Holder, R. and Watts, A. (2009). 'The changing shape of "successful" professional footballers'. Journal of Sports Sciences, 27(5), pp.419-426.

Nevill, A.M., Newell, S.M. and Gale, S. (1996). 'Factors associated with home advantage in English and Scottish soccer matches'. Journal of sports sciences, 14(2), pp.181-186.

O'Donoghue, P. (2009). Research methods for sports performance analysis. Routledge.

Oberstone, J. (2009). 'Differentiating the top English premier league football clubs from the rest of the pack: Identifying the keys to success'. Journal of Quantitative Analysis in Sports, 5(3).

Osgnach, C., Poser, S., Bernardini, R., Rinaldo, R. and Di Prampero, P.E. (2010). 'Energy cost and metabolic power in elite soccer: a new match analysis approach'. Med Sci Sports Exerc, 42(1), pp.170-178.

Petersen, C., Pyne, D., Portus, M. and Dawson, B. (2009). 'Validity and reliability of GPS units to monitor cricket-specific movement patterns'. International journal of sports physiology and performance, 4(3), pp.381-393.

Pettit and Hughes (2001) eds. Hughes, M. and James, N., 2008. Notational analysis of soccer. F. Prot (Ed.), 5, pp.644-660.

Plummer, B.T. (2013). 'Analysis of attacking possessions leading to a goal attempt, and goal scoring patterns within men's elite soccer'. Journal of Sports Science and Medicine, 1(1), pp.1-38.

Pratas, J.M., Volossovitch, A. and Carita, A.I. (2018). 'Goal scoring in elite male football: A systematic review' Journal of science and medicine in sport, 12(5), pp.2275-2335.

Rampinini, E., Coutts, A.J., Castagna, C., Sassi, R. and Impellizzeri, F.M. (2007). 'Variation in top level soccer match performance'. International journal of sports medicine, 28(12), pp.1018-1024.

Rampinini, E., Impellizzeri, F.M., Castagna, C., Azzalin, A. and Wisløff, U. (2008). 'Effect of match-related fatigue on short-passing ability in young soccer players'. Medicine and science in sports and exercise, 40(5), pp.934-942.

Rampinini, E., Impellizzeri, F.M., Castagna, C., Coutts, A.J. and Wisløff, U. (2009) 'Technical performance during soccer matches of the Italian Serie A league: Effect of fatigue and competitive level'. Journal of science and medicine in sport, 12(1), pp.227-233.

Randers, M.B., Mujika, I., Hewitt, A., Santisteban, J., Bischoff, R., Solano, R., Zubillaga, A., Peltola, E., Krustrup, P. and Mohr, M. (2010). 'Application of four different football match analysis systems: A comparative study'. Journal of sports sciences, 28(2), pp.171-182.

Read, D.B., Jones, B., Williams, S., Phibbs, P.J., Darrall-Jones, J.D., Roe, G.A., Weakley, J.J., Rock, A. and Till, K. (2018). 'The physical characteristics of specific phases of play during rugby union match play'. International Journal of Sports Physiology and Performance, 13(10), pp.1331-1336.

Redwood-Brown, A. (2008). 'Passing patterns before and after goal scoring in FA Premier League Soccer'. International Journal of Performance Analysis in Sport, 8(3), pp.172-182.

Redwood-Brown, A., O'Donoghue, P., Robinson, G. and Neilson, P. (2012). 'The effect of score-line on work-rate in English FA Premier League soccer'. International Journal of Performance Analysis in Sport, 12(2), pp.258-271.

Reilly, T., Bangsbo, J. and Franks, A. (2000). 'Anthropometric and physiological predispositions for elite soccer'. Journal of Sports Sciences, 18: 669–683.

Reilly, T., Drust, B. and Clarke, N. (2008). 'Muscle fatigue during football match-play'. Sports Medicine, 38(5), pp.357-367.

Rein, R. and Memmert, D. (2016). 'Big data and tactical analysis in elite soccer: future challenges and opportunities for sports science'. SpringerPlus, 5(1), pp.1-13.

Riboli, A., Esposito, F. and Coratella, G. (2021). 'The distribution of match activities relative to the maximal intensities in elite soccer players: implications for practice'. Research in Sports Medicine, pp.1-12.

Rienzi, E., Drust, B., Reilly, T., Carter, J.E.X.L. and Martin, A. (2000). 'Investigation of anthropometric and work-rate profiles of elite South American international soccer players'. Journal of sports medicine and physical fitness, 40(2), p.162.

Roberts, K.N. (2021). 'An Examination of the Physical and Technical Game Performance of a Division I Women'S Soccer Team Across Varying Rest Periods' (Doctoral dissertation, Middle Tennessee State University).

Ruiz-Ruiz, C., Fradua, L., Fernández-GarcÍa, Á. and Zubillaga, A. (2013). 'Analysis of entries into the penalty area as a performance indicator in soccer'. European Journal of Sport Science, 13(3), pp.241-248.

Russell, M., Rees, G. and Kingsley, M.I. (2013). 'Technical demands of soccer match play in the English championship'. The Journal of Strength & Conditioning Research, 27(10), pp.2869-2873.

Sampaio, J. and Maçãs, V. (2012). 'Measuring tactical behaviour in football'. International journal of sports medicine, 33(05), pp.395-401.

Sanchez, M., Ambros, A., Salmon, M., Bhogadi, S., Wilson, R.T., Kinra, S., Marshall, J.D. and Tonne, C. (2017). 'Predictors of daily mobility of adults in peri-urban south India'. International journal of environmental research and public health, 14(7), p.783.

Sarmento, H., Clemente, F.M., Araújo, D., Davids, K., McRobert, A. and Figueiredo, A. (2018). 'What performance analysts need to know about research trends in association football (2012–2016): A systematic review'. Sports medicine, 48(4), pp.799-836.

Sasaki, Y., Nevill, A. and Reilly, T. (1999). Home advantage: A case study of Ipswich Town Football Club during the 1996-97 season. Journal of Sports Sciences, 17, 831.

Schulze, E., Clemens, C., Nopp, S. and Meyer, T. (2019). 'Defensive Balance in Elite Football: Exploring the Development of Goal Scoring Opportunities'. Sport Perf Sci Reports, 60, pp.1-3.

Schulze, E., Julian, R. and Meyer, T. (2021). 'Exploring factors related to goal scoring opportunities in professional football'. Science and Medicine in Football, pp.1-8.

Schware, A.W. (2019). How women got a foot in the game. NCAA

Scott, M.T., Scott, T.J. and Kelly, V.G. (2016). 'The validity and reliability of global positioning systems in team sport: a brief review'. The Journal of Strength & Conditioning Research, 30(5), pp.1470-1490.

Siegle, M. and Lames, M. (2012). 'Game interruptions in elite soccer'. Journal of sports sciences, 30(7), pp.619-624.

Sirotic, A.C., Coutts, A.J., Knowles, H. and Catterick, C. (2009). 'A comparison of match demands between elite and semi-elite rugby league competition'. Journal of sports sciences, 27(3), pp.203-211.

Spencer, M., Bishop, D., Dawson, B. and Goodman, C., 2005. Physiological and metabolic responses of repeated-sprint activities. Sports medicine, 35(12), pp.1025-1044.

Stølen, T., Chamari, K., Castagna, C. and Wisløff, U. (2005). 'Physiology of soccer'. Sports medicine, 35(6), pp.501-536.

Stratton, G., Reilly, T., Richardson, D. and Williams, A.M. (2004). Youth soccer: From science to performance. Psychology Press.

Szwarc, A., 2004. Effectiveness Of Brazilian And German Teams And The Teams Defeated By Them During The 17th Fifa World Cup. Kinesiology, 36(1).

Tandon, P.S., Saelens, B.E., Zhou, C. and Christakis, D.A. (2018). 'A comparison of preschoolers' physical activity indoors versus outdoors at child care'. International journal of environmental research and public health, 15(11), p.2463.

Taylor, B.J., Mellalieu, D.S., James, N. and Barter, P. (2010). 'Situation variable effects and tactical performance in professional association football'. International Journal of Performance Analysis in Sport, 10(3), pp.255-269.

Taylor, J.B., Mellalieu, S.D., James, N. and Shearer, D.A. (2008). 'The influence of match location, quality of opposition, and match status on technical performance in professional association football'. Journal of sports sciences, 26(9), pp.885-895.

Tenga, A. and Sigmundstad, E. (2011). 'Characteristics of goal-scoring possessions in open play: Comparing the top, in-between and bottom teams from professional soccer league'. International Journal of Performance Analysis in Sport, 11(3), pp.545-552.

Tenga, A., Holme, I., Ronglan, L.T. and Bahr, R. (2010a). 'Effect of playing tactics on goal scoring in Norwegian professional soccer'. Journal of Sports Sciences, 28(3), pp.237-244.

Tenga, A., Ronglan, L.T. and Bahr, R. (2010b). 'Measuring the effectiveness of offensive match-play in professional soccer'. European Journal of Sport Science, 10(4), pp.269-277.

Tierney, P.J., Young, A., Clarke, N.D. and Duncan, M.J. (2016). 'Match play demands of 11 versus 11 professional football using Global Positioning System tracking: Variations across common playing formations'. Human movement science, 49, pp.1-8.

Tucker, W., Mellalieu, D.S., James, N. and Taylor, B.J. (2005). 'Game location effects in professional soccer: A case study'. International Journal of Performance Analysis in Sport, 5(2), pp.23-35.

Varley, M.C., Fairweather, I.H. and Aughey, R.J. (2012). 'Validity and reliability of GPS for measuring instantaneous velocity during acceleration, deceleration, and constant motion'. Journal of sports sciences, 30(2), pp.121-127.

Vaz, M.S., Ribeiro, Y.S., Pinheiro, E.S. and Del Vecchio, F.B. (2019). 'Psychophysiological profile and prediction equations for technical performance of football players'. Revista Brasileira de Ciências do Esporte, 41, pp.215-221.

Vickery, W.M., Dascombe, B.J., Baker, J.D., Higham, D.G., Spratford, W.A. and Duffield, R. (2014). 'Accuracy and reliability of GPS devices for measurement of sports-specific movement patterns related to cricket, tennis, and field-based team sports'. The Journal of Strength & Conditioning Research, 28(6), pp.1697-1705.

Vigh-Larsen, J.F., Dalgas, U. and Andersen, T.B. (2018). 'Position-specific acceleration and deceleration profiles in elite youth and senior soccer players'. The Journal of Strength & Conditioning Research, 32(4), pp.1114-1122.

Vogelbein, M., Nopp, S. and Hökelmann, A., 2014. Defensive transition in soccer–are prompt possession regains a measure of success? A quantitative analysis of German Fußball-Bundesliga 2010/2011. Journal of sports sciences, 32(11), pp.1076-1083.

Wass, J., Mernagh, D., Pollard, B., Stewart, P., Fox, W., Parmar, N., Jones, B., Kilduff, L. and Turner, A.N. (2020). 'A comparison of match demands using ball-in-play vs. whole match data in elite male youth soccer players'. Science and Medicine in Football, 4(2), pp.142-147.

Whitehead, S., Till, K., Weaving, D. and Jones, B. (2018). 'The use of microtechnology to quantify the peak match demands of the football codes: a systematic review'. Sports medicine, 48(11), pp.2549-2575.

Willmont, A. (2016). 'FieldWiz GPS pilot Research repor't. Sport and Exercise Science Consultancy Unit. 23p.

Wragg, C.B., Maxwell, N.S. and Doust, J.H. (2000). 'Evaluation of the reliability and validity of a soccer-specific field test of repeated sprint ability'. European journal of applied physiology, 83(1), pp.77-83.

Wright, C., Atkins, S., Polman, R., Jones, B. and Sargeson, L. (2011). 'Factors associated with goals and goal scoring opportunities in professional soccer'. International Journal of Performance Analysis in Sport, 11(3), pp.438-449.

Yang, G., Leicht, A.S., Lago, C. and Gómez, M.Á. (2018). 'Key team physical and technical performance indicators indicative of team quality in the soccer Chinese super league'. Research in Sports Medicine, 26(2), pp.158-167.

Yiannakos, A. and Armatas, V. (2006). 'Evaluation of the goal scoring patterns in European Championship in Portugal 2004'. International Journal of Performance Analysis in Sport, 6(1), pp.178-188.

Young, D., Malone, S., Beato, M., Mourot, L. and Coratella, G. (2018). 'Identification of maximal running intensities during elite hurling match-play'. The Journal of Strength & Conditioning Research, 34(9), pp.2608-2617.

Young, D., Malone, S., Collins, K., Mourot, L., Beato, M. and Coratella, G. (2019). 'Metabolic power in hurling with respect to position and halves of match-play'. PloS one, 14(12), pp. 225-947.

Zhou, C., Calvo, A.L., Robertson, S. and Gómez, M.Á. (2021). 'Long-term influence of technical, physical performance indicators and situational variables on match outcome in male professional Chinese soccer'. Journal of Sports Sciences, 39(6), pp.598-608.

Appendix A

Technical KPI's Totals – Match Outcome			
Parameter	**Win**	**Loss**	**Draw**
Entry into Penalty Area For	*81*	*129*	*86*
Entry into Penalty Area Against	*78*	*109*	*58*
Aerial Duel Won	*207*	*252*	*193*
Aerial Duel Lost	*157*	*236*	*133*
Dribble Completed	*26*	*45*	*28*
Dribble incomplete	*13*	*42*	*12*
Pass For	*460*	*914*	*641*
Successful Pass For	*340*	*657*	*494*
FWD Pass For	*295*	*499*	*323*
Successful Passes FWD For	*194*	*281*	*207*
Number of BWD/Lateral Passes For	*165*	*415*	*318*
Pass Against	*459*	*750*	*426*
Successful Pass Against	*351*	*577*	*300*
Shot For	*48*	*54*	*46*
Shot Against	*30*	*45*	*19*

Technical KPI's Totals – Match Outcome			
Parameter	**Win**	**Loss**	**Draw**
Shot On Target For	*32*	*21*	*25*
Shots inside Penalty Area For	*37*	*40*	*36*
Shot On Target Against	*15*	*27*	*13*
Shots inside Penalty Area Against	*21*	*31*	*12*
Tackle Won	*56*	*58*	*41*
50/50 Tackle Lost	*31*	*72*	*29*

Mean±SD Technical KPI Outputs - Match Outcome			
Parameter	**Win**	**Loss**	**Draw**

Fouls Committed	*33*	*26*	*27*
Cross For	*38*	*73*	*38*
Cross Successful	*21*	*33*	*18*
Cross Unsuccessful	*17*	*40*	*20*
Cross Against	*34*	*49*	*26*
Corner For	*19*	*24*	*14*
Corner Against	*14*	*21*	*13*
Free Kick For	*12*	*16*	*14*
Free Kick Against	*14*	*12*	*12*

Table 2.1

Table 2.2

Tables 2.1 (above left) and 2.2 (above right) show the raw total data for the selection of technical performance indicators analysed in the present study, distributed across outcome (Win, Loss and Draw).

Pass For	*153±34.9*	*209±41.8*	*214+53.1*
Pass Against	*153±51.4*	*188±29.8*	*142±48.1*
% Successful Passes For	*76+5.0*	*71+7.0*	*74±6.4*
% Passes FWD For	*64±6.7*	*55±4.6*	*57±7.3*
% Successful FWD Passes For	*66±8.6*	*55±8.8*	*62±5.6*
% BWD/Lateral Passes For	*36±6.7*	*45±4.6*	*49±7.8*
Entry into Penalty Area For	*27±6.4*	*32±7.2*	*29±6.1*
Entry into Penalty Area Against	*26±5.4*	*27±9.4*	*19±5.0*
% Aerial Duels Won	*57±12.5*	*52±13.1*	*59±13.5*
% Dribble Completed	*66±11.2*	*52±4.7*	*70±11.4*
% Tackles Won	*64±9.4*	*45±3.7*	*58±3.7*
Shot For	*16±6.0*	*14±4.1*	*15±5.7*
Shot Against	*10±3.5*	*11±4.0*	*6±2.1*
% Shots on Target For	*66±13.5*	*40±12.2*	*58±12.5*
% Shots Inside Penalty Area For	*75±6.6*	*74±6.8*	*79±5.3*
Cross For	*13±6.0*	*18±6.0*	*13±3.5*
% Cross Successful	*57±10*	*46±10.3*	*48±8.1*
Cross Against	*5±2.1*	*5±2.2*	*4±1.3*

Table 2.3 (above) shows the averages for the selection of technical performance indicators analysed in the present study, distributed across outcome (Win, Loss and Draw) – presented as Mean±SD

Mean±SD of Technical KPI Outputs – 5mins Preceding Goals For and Against		
Parameter	**Goal Scored**	**Goal Conceded**
Pass For	*25±9.9*	*20±10.5*
% Successful Passes For	*76.8±14.1*	*63.9±14.8*
% Passes FWD For	*64.1±16.7*	*58.8±18.0-*
% Successful FWD Passes For	*69.1±18.7*	*50.7±20.5*
% BWD/Lateral Passes For	*35.3±12.9*	*37.9±13.3*
Pass Against	*14±9.4*	*22±8.8*
% Successful Pass Against	*64.0±20.1*	*75.1±15.2*
Entry into Penalty Area For	*4±1.9*	*3±2.1*
Entry into Penalty Area Against	*2±2.5*	*4±2.4*
% Aerial Duels Won	*58.8±15.5*	*51.5±16.3*
% Dribble Completed	*57.2±33.6*	*57.6±31.2*
% Tackles Won	*69.6±29.0*	*35.2±30.3*
Cross For	*3±1.8*	*2±1.9*
% Cross Successful	*51.5±35.4*	*20.9±35.0*
Cross Against	*1±1.1*	*1±1.2*
% Shots on Target For	*83.2±37.7*	*46.7±39.5*
% Shots Inside Penalty Area For	*83.7±35.8*	*62.9±38.1*
Shot Against	*1±1.2*	*2±1.2*
% Shots on Target Against	*25.0±46.0*	*90.9±46.3*

Table 2.4 **(above)** shows the averages for the selection of technical performance indicators in the 5-minute period preceding goals scored and goals conceded – presented as Mean±SD

Parameter	Team Totals - All Matches
Distance (Meters) Per Minute (m/min)	*5935±46.6*
Sprint Count (n)	*3643±52.8*
High Intensity Distance Covered (m)	*86792±1411.7*
Sprint Total Distance (m)	*67501±1564.7*
Accelerations <4m.s (n)	*663±12.3*
Total Distance Covered (Km)	*772.5±9.9*

Table 2.5 (above) and Table 2.6 (below) shows Team Total and Average Physical Outputs, respectively for all of the 10 matches analysed – presented as Mean±SD

Parameter	Team Averages - All Matches
Distance (Meters) Per Minute (m/min)	*73.5±4.4*
Sprint Count (n)	*45.1±5.3*
High Intensity Distance Covered (m)	*1071.3±45.4*
Sprint Total Distance (m)	*828.6±160.7*
Accelerations <4m.s (n)	*8.4±1.4*
Total Distance Covered (Km)	*9.5±0.8*

Team Totals - Outcome			
Parameter	**Win**	**Loss**	**Draw**
Distance (Meters) Per Minute (m/min)	*1915.8±48.5*	*2337.3±44.5*	*1682.2±44.0*
Sprint Count (n)	*122.5±52.3*	*1463±60.2*	*955±53.3*
High Intensity Distance Covered (m)	*30044±1442.3*	*34093±1532.9*	*22659.3±1228.6*
Sprint Total Distance (m)	*24829±1526.6*	*25906.9±1273.6*	*16765.9±1665.6*
Accelerations <4m.s (n)	*218±12.5*	*264±12.7*	*181±11.9*
Total Distance Covered (Km)	*256.9±9.9*	*305.6±9.8*	*210±10.6*

Table 2.7 (above) and Table 2.8 (below) shows Team Total and Average Physical Outputs, respectively for the 10 matches analysed, distributed across outcome (Win, Loss and Draw) – presented as Mean±SD

Team Averages - Outcome			
Parameter	**Win**	**Loss**	**Draw**
Distance (Meters) Per Minute (m/min)	*73.8±4.6*	*75.9±12.7*	*70.6±4.1*
Sprint Count (n)	*47±5.2*	*47±5.8*	*40±5.3*
High Intensity Distance Covered (m)	*1160.8±148*	*1096±155.5*	*946±107.5*
Sprint Total Distance (m)	*945.8±158.9*	*836.6±134.8*	*691.6±168.5*
Accelerations <4m.s (n)	*9±1.4*	*9±1.3*	*8±1.4*
Total Distance Covered (Km)	*9.9±0.8*	*9.9±0.9*	*8.8±1.0*

Appendix B

Positional Averages - All Matches (90mins)

	Forwards	Midfielders	Wide Defenders	Central Defenders
Distance (Meters) Per Minute (m/min)	*73.3±5.3*	*81.8±8.6*	*70.4±3.2*	*70.0±5.3*
Sprint Count (n)	*48.2±10.5*	*52.6±7.6*	*44.6±3.9*	*35.8±7.9*
High Intensity Distance Covered (m)	*1236.5±379.4*	*1303.4±191.6*	*1051.8±103.2*	*826.9±199.3*
Sprint Total Distance (m)	*862.2±229.8*	*950.5±146.1*	*782.7±76.1*	*645.6±164*
Accelerations (n)	*10.5±2.0*	*7.6±2.8*	*9.0±2.8*	*6.8±2.4*
Total Distance Covered (Km)	*9.4±0.8*	*10.5±1.2*	*9.2±0.7*	*8.7±1.7*

Table 6.1 (above) and Table 6.2 (below) show Positional Average and Total Physical Outputs, respectively. These are full-match (90mins) measures presented as Mean±SD

Positional Totals - All Matches (90mins)

	Forwards	Midfielders	Wide Defenders	Central Defenders
Distance (Meters) Per Minute (m/min)	*1589.5±37*	*1614.8±38.7*	*1408.4±6.5*	*1499.2±34.2*
Sprint Count (n)	*1083±28.4*	*1050±28.1*	*885±8.0*	*709±16*
High Intensity Distance Covered (m)	*25106±164.4*	*25587.5±764.9*	*21050±206.6*	*16504±399.9*
Sprint Total Distance (m)	*18613±615.2*	*20110±623.6*	*15643.3±152.2*	*11911.9±325*
Accelerations (n)	*227±7.4*	*144±6.8*	*172±5.6*	*130±5*
Total Distance Covered (Km)	*205±5.5*	*210±5.3*	*183.4±1.5*	*174.1±3.5*

Positional Totals - Outcome (Win, Draw, Loss)			
	Forwards		
Parameters	**Win**	**Draw**	**Loss**
Distance (Meters) Per Minute (m/min)	*578.6±38.6*	*490±30.5*	*520.9±29.1*
Sprint Count (n)	*386±28.7*	*343±32.1*	*354±28.7*
High Intensity Distance Covered (m)	*9499.6±762*	*6269±816.1*	*8677.8±773*
Sprint Total Distance (m)	*6995.4±628.9*	*5232±591.9*	*6384.8±654.5*
Accelerations (n)	*89±7.8*	*64±7.0*	*74±5.2*
Total Distance Covered (Km)	*76.8±5.6*	*59.8±4.9*	*68.4±3.9*

Table 6.3 (above) and Table 6.4 (below) show Forwards Total and Average Physical Outputs respectively for matches won, lost, and drawn – presented as Mean±SD

Positional Averages - Outcome (Win, Draw, Loss)			
	Forwards		
Parameters	**Win**	**Draw**	**Loss**
Distance (Meters) Per Minute (m/min)	*72.9±5.5*	*71.1±4.2*	*75.1±4.6*
Sprint Count (n)	*48.8±10.9*	*43.7±9.9*	*51±13.1*
High Intensity Distance Covered (m)	*1210.5±394.7*	*1079.4±387.7*	*1373.4±471.9*
Sprint Total Distance (m)	*988.1±236*	*760.5±189.7*	*919.1±282.9*
Accelerations (n)	*11.3±21.*	*9.3±1.8*	*10.8±1.9*
Total Distance Covered (Km)	*9.6±0.6*	*8.6±0.9*	*9.8±0.7*

Positional Totals - Outcome (Win, Draw, Loss)			
	Midfielders		
Parameters	**Win**	**Draw**	**Loss**
Distance (Meters) Per Minute (m/min)	*578±40.9*	*378.3±30.1*	*658.5±33.8*
Sprint Count (n)	*382±29.4*	*218±28.5*	*450±28*
High Intensity Distance Covered (m)	*9682±803.8*	*5468.7±667.8*	*10436.8±724.8*
Sprint Total Distance (m)	*7927.6±647.7*	*3973±629*	*8209.1±536.1*
Accelerations (n)	*54±3.9*	*21±5.9*	*69±5.4*
Total Distance Covered (Km)	*76.9±5.6*	*46.2±4.9*	*81.9±5.6*

Table 6.5 (above) and Table 6.6 (below) show Midfielders Total and Average Physical Outputs respectively for matches won, lost, and drawn – presented as Mean±SD

Positional Averages - Outcome (Win, Draw, Loss)			
	Midfielders		
Parameters	**Win**	**Draw**	**Loss**
Distance (Meters) Per Minute (m/min)	*82.7±8.0*	*80.1±9.8*	*82.3±5.2*
Sprint Count (n)	*55±7.8*	*45±9.1*	*56.5±6.9*
High Intensity Distance Covered (m)	*1385.9±198*	*1106.9±223.3*	*1389±201.4*
Sprint Total Distance (m)	*989.1±149.5*	*816.2±165*	*1022±147.7*
Accelerations (n)	*7.9±2.8*	*5.3±2.0*	*9.0±2.3*
Total Distance Covered (Km)	*11.1±1.3*	*9.4±1.4*	*10.9±1.0*

Positional Totals - Outcome (Win, Draw, Loss)			
	Wide Defenders		
Parameters	**Win**	**Draw**	**Loss**
Distance (Meters) Per Minute (m/min)	*427.3±6.7*	*411.8±6.2*	*569.3±5.3*
Sprint Count (n)	*285±8.2*	*250±8.7*	*350±8.3*
High Intensity Distance Covered (m)	*6607±214.3*	*6043±213.2*	*8340.3±244.5*
Sprint Total Distance (m)	*4800.3±155.7*	*4531.7±140.7*	*6311.3±193.1*
Accelerations (n)	*42±3.8*	*66±6.5*	*64±2.0*
Total Distance Covered (Km)	*57.1±1.5*	*52.2±1.8*	*74.1±1.7*

Table 6.7 (above) and Table 6.8 (below) show Wide Defenders Total and Average Physical Outputs respectively for matches won, lost, and drawn – presented as Mean±SD

Positional Averages - Outcome (Win, Draw, Loss)			
	Wide Defenders		
Parameters	**Win**	**Draw**	**Loss**
Distance (Meters) Per Minute (m/min)	*71.2±5.5*	*68.6±3.1*	*71.2±2.7*
Sprint Count (n)	*47.8±4.1*	*42±4.3*	*44±4.1*
High Intensity Distance Covered (m)	*1111.2±106.9*	*1007.3±106.6*	*1042.8±122.1*
Sprint Total Distance (m)	*800.1±77.9*	*755.4±70.4*	*788.9±95*
Accelerations (n)	*7.3±1.9*	*11.3±3.1*	*8.5±1.0*
Total Distance Covered (Km)	*9.5±0.7*	*8.7±0.9*	*9.3±0.8*

Positional Totals - Outcome (Win, Draw, Loss)			
	Central Defenders		
Parameters	**Win**	**Draw**	**Loss**
Distance (Meters) Per Minute (m/min)	*403±35.2*	*507.3±40.5*	*588.9±40.5*
Sprint Count (n)	*216±14.7*	*185±15.4*	*308±3.9*
High Intensity Distance Covered (m)	*5321.9±370.9*	*4212.3±333.9*	*6970±280.1*
Sprint Total Distance (m)	*3863.5±305.7*	*3027.1±276.2*	*5021±221*
Accelerations (n)	*43±5.1*	*30±4.7*	*57±4.7*
Total Distance Covered (Km)	*55.2±3.6*	*51.8±2.2*	*67.1±4.7*

Table 6.9 (above) and Table 7.1 (below) show Central Defenders Total and Average Physical Outputs respectively for matches won, lost, and drawn – presented as Mean±SD

Positional Averages - Outcome (Win, Draw, Loss)			
	Central Defenders		
Parameters	**Win**	**Draw**	**Loss**
Distance (Meters) Per Minute (m/min)	*67.2±5.1*	*67.9±5.6*	73.7±2.0
Sprint Count (n)	*36.3±7.2*	*31.3±7.8*	38.8±3.2
High Intensity Distance Covered (m)	*887±184.4*	*707.9±166.5*	871.1±140.2
Sprint Total Distance (m)	*643.9±152.9*	*671.2±153.6*	627.7±110.5
Accelerations (n)	*7.2±2.4*	*5.3±2.2*	7.5±2.3
Total Distance Covered (Km)	*9.2±1.8*	*8.7±1.1*	8.4±2.3

5mins leading up to Goal Scored (Average Positional and Team Data)					
Parameter	**Team Totals**	**Forward Totals**	**Midfield Totals**	**Wide Defender Totals**	**Central Defender Totals**
Distance (Meters) Per Minute (m/min)	*93.9*	*95.3*	*102.3*	*90.1*	*84.5*
Sprint Count (n)	*3*	*3*	*3*	*2*	*2*
High Intensity Distance Covered (m)	*64.9*	*77.7*	*76.4*	*56.2*	*43*
Sprint Total Distance (m)	*49.9*	*60.3*	*56.6*	*46.6*	*38.7*
Accelerations (n)	*3*	*3*	*2*	*3*	*2*
Total Distance Covered (m)	*496.3*	*503.2*	*541.9*	*476*	*446.9*

Table 7.2 (above) and Table 7.3 (below) show Team and Positional Average and Total Physical Outputs respectively for the 5 minutes preceding a goal scored – Raw Data is Presented

5mins leading up to Goal Scored (Total Positional and Team Data)					
Parameter	**Team Totals**	**Forward Totals**	**Midfield Totals**	**Wide Defender Totals**	**Central Defender Totals**
Distance (Meters) Per Minute (m/min)	*13216.4*	*3693*	*4285*	*2703.3*	*2535.1*
Sprint Count (n)	*370*	*122*	*118*	*74*	*56*
High Intensity Distance Covered (m)	9145.4	3008	3163.4	1689.8	1289
Sprint Total Distance (m)	*7027.1*	*2350.8*	*2342.6*	*1396.7*	*1160.8*
Accelerations (n)	*388*	*137*	*104*	*82*	*65*
Total Distance Covered (m)	*69855.9*	*19529.8*	*22700.3*	*14279.5*	*13347.1*

5mins leading up to Goal Conceded (Total Positional and Team Data)					
Parameter	**Team Totals**	**Forward Totals**	**Midfield Totals**	**Wide Defender Totals**	**Central Defender Totals**
Distance (Meters) Per Minute (m/min)	*11018.1*	*3024.2*	*3703*	*2110.8*	*2180.1*
Sprint Count (n)	*308*	*76*	*102*	*75*	*52*
High Intensity Distance Covered (m)	*7397.7*	*2029.1*	*2850.2*	*1909*	*1496.6*
Sprint Total Distance (m)	*5436.6*	*1257.3*	*1958.7*	*1265.9*	*954.7*
Accelerations (n)	*304*	*82*	*91*	*76*	*55*
Total Distance Covered (m)	*56654.8*	*15221.2*	*19264.9*	*10789.3*	*11378.7*

Table 7.4 (above) and Table 7.5 (below) show Team and Positional Total and Average Physical Outputs respectively for the 5 minutes preceding a conceded goal – Raw Data is Presented

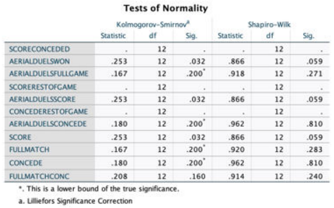
5mins leading up to Goal Conceded (Average Positional and Team Data)					
Parameter	**Team Totals**	**Forward Totals**	**Midfield Totals**	**Wide Defender Totals**	**Central Defender Totals**
Distance (Meters) Per Minute (m/min)	*96*	*90.5*	*108.8*	*88*	*90.8*
Sprint Count (n)	*3*	*2*	*3*	*3*	*3*
High Intensity Distance Covered (m)	*64.3*	*60.3*	*83*	*79.3*	*62.4*
Sprint Total Distance (m)	*47.3*	*38*	*57.3*	*52.7*	*39.8*
Accelerations (n)	*3*	*2*	*3*	*3*	*2*
Total Distance Covered (m)	*498.3*	*466*	*566.3*	*449.6*	*474.1*

Appendix C

Percentage Parameters – Goals Scored

Figures reading from left to right; Normality Output, Goal Scored vs. Goal Conceded t-test, Goals Scored T-Tests, Area under ROC Curve Outputs and Overall Model Quality Outputs

1. % Aerial Duels Won

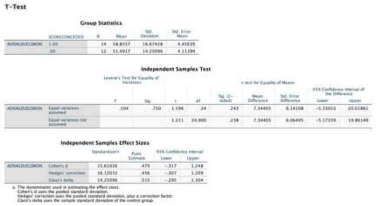


Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SCORECONCEDED	.	12	.	.	12	.
AERIALDUELSWON	.253	12	.032	.866	12	.059
AERIALDUELSFULLGAME	.167	12	.200[*]	.918	12	.271
SCORERESTOFGAME	.	12	.	.	12	.
AERIALDUELSSCORE	.253	12	.032	.866	12	.059
CONCEDERESTOFGAME	.	12	.	.	12	.
AERIALDUELSCONCEDE	.180	12	.200[*]	.962	12	.810
SCORE	.253	12	.032	.866	12	.059
FULLMATCH	.167	12	.200[*]	.920	12	.283
CONCEDE	.180	12	.200[*]	.962	12	.810
FULLMATCHCONC	.208	12	.160	.914	12	.240

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction



T-Test

Group Statistics

	SCORECONCEDED	N	Mean	Std. Deviation	Std. Error Mean
AERIALDUELSWON	1.00	14	58.8357	16.67428	4.45639
	.00	12	51.4917	14.25096	4.11390

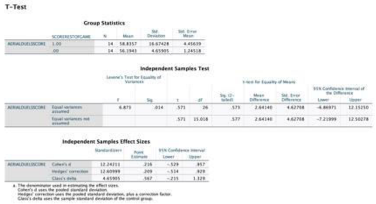
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
AERIALDUELSWON	Equal variances assumed	.104	.750	1.196	24	.243	7.34405	6.14108	-5.33053	20.01862
	Equal variances not assumed			1.211	24.000	.238	7.34405	6.06495	-5.17339	19.86149

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
AERIALDUELSWON	Cohen's d	15.61036	.470	-.317	1.248
	Hedges' correction	16.12032	.456	-.307	1.209
	Glass's delta	14.25096	.515	-.295	1.304

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



T-Test

Group Statistics

	SCORERESTOFGAME	N	Mean	Std. Deviation	Std. Error Mean
AERIALDUELSSCORE	1.00	14	58.8357	16.67428	4.45639
	.00	14	56.1943	4.65905	1.24518

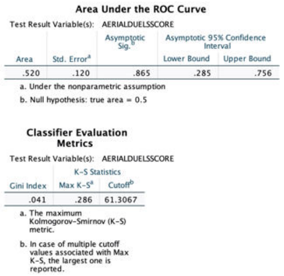
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
AERIALDUELSSCORE	Equal variances assumed	6.873	.014	.571	26	.573	2.64140	4.62708	-6.86971	12.15250
	Equal variances not assumed			.571	15.018	.577	2.64140	4.62708	-7.21999	12.50278

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
AERIALDUELSSCORE	Cohen's d	12.24211	.216	-.529	.957
	Hedges' correction	12.60999	.209	-.514	.929
	Glass's delta	4.65905	.567	-.215	1.329

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



Area Under the ROC Curve

Test Result Variable(s): AERIALDUELSSCORE

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.520	.120	.865	.285	.756

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

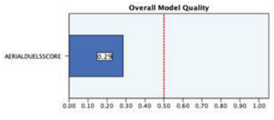
Classifier Evaluation Metrics

Test Result Variable(s): AERIALDUELSSCORE

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
.041	.286	61.3067

a. The maximum Kolmogorov-Smirnov (K-S) metric.

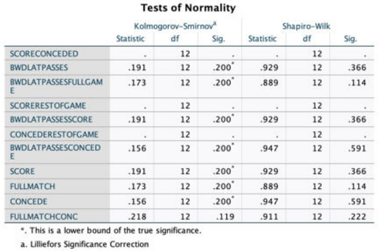
b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



A good model has a value above 0.5
A value less than 0.5 indicates the model is no better than random prediction

Note: Use caution in interpreting this chart since it only reflects a general measure of overall model quality. The model quality can be considered "good" even if the correct prediction rate for positive responses does not meet the specified minimum probability. Use the classification table to examine correct prediction rates.

2. % BWD/LAT Passes

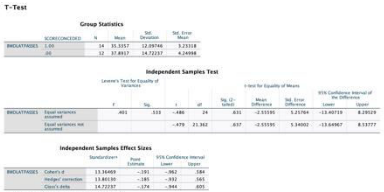


Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SCORECONCEDED	.	12	.	.	12	.
BWDLATPASSES	.191	12	.200[*]	.929	12	.366
BWDLATPASSESFULLGAME	.173	12	.200[*]	.889	12	.114
SCORERESTOFGAME	.	12	.	.	12	.
BWDLATPASSESSCORE	.191	12	.200[*]	.929	12	.366
CONCEDERESTOFGAME	.	12	.	.	12	.
BWDLATPASSESCONCEDE	.156	12	.200[*]	.947	12	.591
SCORE	.191	12	.200[*]	.929	12	.366
FULLMATCH	.173	12	.200[*]	.889	12	.114
CONCEDE	.156	12	.200[*]	.947	12	.591
FULLMATCHCONC	.218	12	.119	.911	12	.222

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction



T-Test

Group Statistics

	SCORECONCEDED	N	Mean	Std. Deviation	Std. Error Mean
BWDLATPASSES	1.00	14	35.3357	12.09746	3.23318
	.00	12	37.8917	14.72237	4.24998

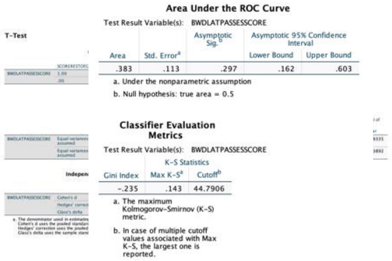
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
BWDLATPASSES	Equal variances assumed	.401	.533	-.486	24	.631	-2.55595	5.25764	-13.40719	8.29529
	Equal variances not assumed			-.479	21.362	.637	-2.55595	5.34002	-13.64967	8.53777

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
BWDLATPASSES	Cohen's d	13.36469	-.191	-.962	.584
	Hedges' correction	13.80130	-.185	-.932	.565
	Glass's delta	14.72237	-.174	-.944	.605

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



T-Test

Area Under the ROC Curve

Test Result Variable(s): BWDLATPASSESSCORE

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.383	.113	.297	.162	.603

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

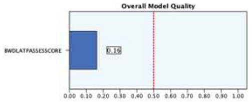
Classifier Evaluation Metrics

Test Result Variable(s): BWDLATPASSESSCORE

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
-.235	.143	44.7906

a. The maximum Kolmogorov-Smirnov (K-S) metric.

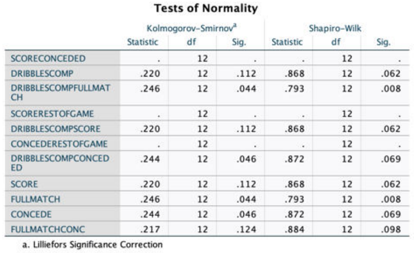
b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



A good model has a value above 0.5
A value less than 0.5 indicates the model is no better than random prediction

Note: Use caution in interpreting this chart since it only reflects a general measure of overall model quality. The model quality can be considered "good" even if the correct prediction rate for positive responses does not meet the specified minimum probability. Use the classification table to examine correct prediction rates.

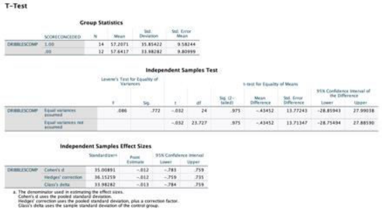
3. % Dribble Completed



Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SCORECONCEDED	.	12	.	.	12	.
DRIBBLESCOMP	.220	12	.112	.868	12	.062
DRIBBLESCOMPFULLMATCH	.246	12	.044	.793	12	.008
SCORERESTOFGAME	.	12	.	.	12	.
DRIBBLESCOMPSCORE	.220	12	.112	.868	12	.062
CONCEDERESTOFGAME	.	12	.	.	12	.
DRIBBLESCOMPCONCEDED	.244	12	.046	.872	12	.069
SCORE	.220	12	.112	.868	12	.062
FULLMATCH	.246	12	.044	.793	12	.008
CONCEDE	.244	12	.046	.872	12	.069
FULLMATCHCONC	.217	12	.124	.884	12	.098

a. Lilliefors Significance Correction



T-Test

Group Statistics

	SCORECONCEDED	N	Mean	Std. Deviation	Std. Error Mean
DRIBBLESCOMP	1.00	14	57.2071	35.85422	9.58244
	.00	12	57.6417	33.98282	9.80999

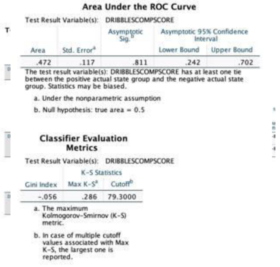
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
DRIBBLESCOMP	Equal variances assumed	.086	.772	-.032	24	.975	-.43452	13.77243	-28.85943	27.99038
	Equal variances not assumed			-.032	23.727	.975	-.43452	13.71347	-28.75494	27.88590

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
DRIBBLESCOMP	Cohen's d	35.00891	-.012	-.783	.759
	Hedges' correction	36.15259	-.012	-.759	.735
	Glass's delta	33.98282	-.013	-.784	.759

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



Area Under the ROC Curve

Test Result Variable(s): DRIBBLESCOMPSCORE

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.472	.117	.811	.242	.702

The test result variable(s): DRIBBLESCOMPSCORE has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

Classifier Evaluation Metrics

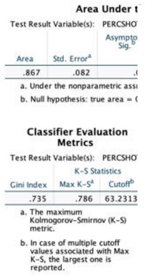
Test Result Variable(s): DRIBBLESCOMPSCORE

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
-.056	.286	79.3000

a. The maximum Kolmogorov-Smirnov (K-S) metric.

b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.

4. % Shots on Target



Area Under t

Test Result Variable(s): PERCSHO

Area	Std. Error[a]	Asympto Sig.[b]
.867	.082	.

a. Under the nonparametric ass

b. Null hypothesis: true area = (

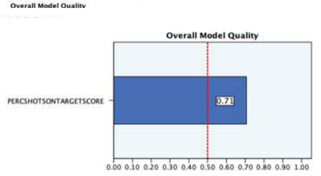
Classifier Evaluation Metrics

Test Result Variable(s): PERCSHO

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
.735	.786	63.2313

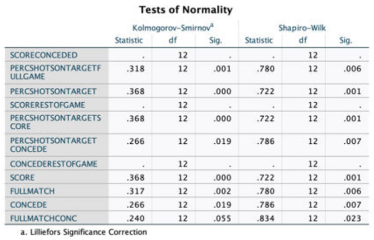
a. The maximum Kolmogorov-Smirnov (K-S) metric.

b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



A good model has a value above 0.5
A value less than 0.5 indicates the model is no better than random prediction

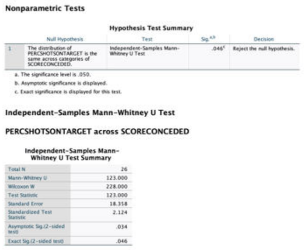
Note: Use caution in interpreting this chart since it only reflects a general measure of overall model quality. The model quality can be considered "good" even if the correct prediction rate for positive responses does not meet the specified minimum probability. Use the classification table to examine ...



Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SCORECONCEDED	.	12	.	.	12	.
PERCSHOTSONTARGETFULLGAME	.318	12	.001	.780	12	.006
PERCSHOTSONTARGET	.368	12	.000	.722	12	.001
SCORERESTOFGAME	.	12	.	.	12	.
PERCSHOTSONTARGETSCORE	.368	12	.000	.722	12	.001
PERCSHOTSONTARGETCONCEDE	.266	12	.019	.786	12	.007
CONCEDERESTOFGAME	.	12	.	.	12	.
SCORE	.368	12	.000	.722	12	.001
FULLMATCH	.317	12	.002	.780	12	.006
CONCEDE	.266	12	.019	.786	12	.007
FULLMATCHCONC	.240	12	.055	.834	12	.023

a. Lilliefors Significance Correction



Nonparametric Tests

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distribution of PERCSHOTSONTARGET is the same across categories of SCORECONCEDED.	Independent-Samples Mann-Whitney U Test	.046[c]	Reject the null hypothesis.

a. The significance level is .050.

b. Asymptotic significance is displayed.

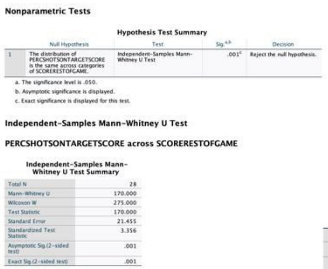
c. Exact significance is displayed for this test.

Independent-Samples Mann-Whitney U Test

PERCSHOTSONTARGET across SCORECONCEDED

Independent-Samples Mann-Whitney U Test Summary

Total N	26
Mann-Whitney U	123.000
Wilcoxon W	228.000
Test Statistic	123.000
Standard Error	18.358
Standardized Test Statistic	2.124
Asymptotic Sig.(2-sided test)	.034
Exact Sig.(2-sided test)	.046



Nonparametric Tests

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distribution of PERCSHOTSONTARGETSCORE is the same across categories of SCORERESTOFGAME.	Independent-Samples Mann-Whitney U Test	.001[c]	Reject the null hypothesis.

a. The significance level is .050.

b. Asymptotic significance is displayed.

c. Exact significance is displayed for this test.

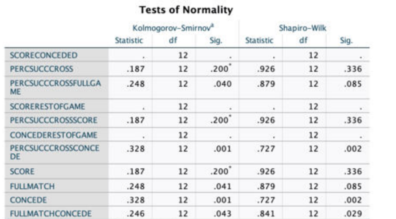
Independent-Samples Mann-Whitney U Test

PERCSHOTSONTARGETSCORE across SCORERESTOFGAME

Independent-Samples Mann-Whitney U Test Summary

Total N	28
Mann-Whitney U	170.000
Wilcoxon W	275.000
Test Statistic	170.000
Standard Error	21.455
Standardized Test Statistic	3.356
Asymptotic Sig.(2-sided test)	.001
Exact Sig.(2-sided test)	.001

5. % Successful Crosses

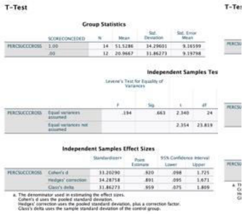


Tests of Normality

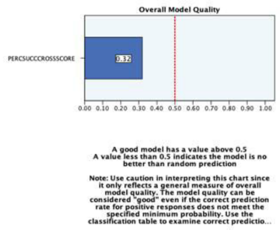
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SCORECONCEDED	.	12	.	.	12	.
PERCSUCCCROSS	.187	12	.200*	.926	12	.336
PERCSUCCCROSSFULLGAME	.248	12	.040	.879	12	.085
SCORERESTOFGAME	.	12	.	.	12	.
PERCSUCCCROSSSCORE	.187	12	.200*	.926	12	.336
CONCEDERESTOFGAME	.	12	.	.	12	.
PERCSUCCCROSSCONCEDE	.328	12	.001	.727	12	.002
SCORE	.187	12	.200*	.926	12	.336
FULLMATCH	.248	12	.041	.879	12	.085
CONCEDE	.328	12	.001	.727	12	.002
FULLMATCHCONCEDE	.246	12	.043	.841	12	.029

*. This is a lower bound of the true

a. Lilliefors Significance Correction



T-Test

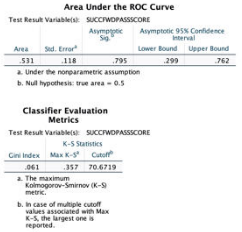


Overall Model Quality

A good model has a value above 0.5
A value less than 0.5 indicates the model is no better than random prediction

Note: Use caution in interpreting this chart since it only reflects a general measure of overall model quality. The model quality can be considered "good" even if the correct prediction rate for positive responses does not meet the specified minimum probability. Use the classification table to examine correct predictio...

values associated with Max K-S, the largest one is



Area Under the ROC Curve

Test Result Variable(s): SUCCFWDPASSSCORE

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.531	.118	.795	.299	.762

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

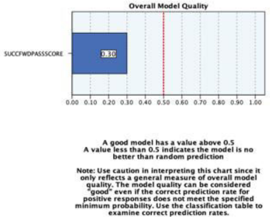
Classifier Evaluation Metrics

Test Result Variable(s): SUCCFWDPASSSCORE

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
.061	.357	70.6719

a. The maximum Kolmogorov-Smirnov (K-S) metric.

b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



Overall Model Quality

A good model has a value above 0.5
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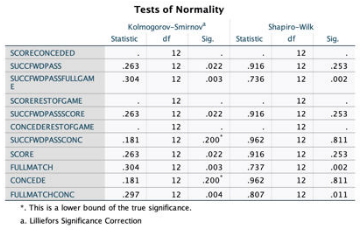
Note: Use caution in interpreting this chart since it only reflects a general measure of overall model quality. The model quality can be considered "good" even if the correct prediction rate for positive responses does not meet the specified minimum probability. Use the classification table to examine correct prediction rates.

6. % Successful Forward Passes

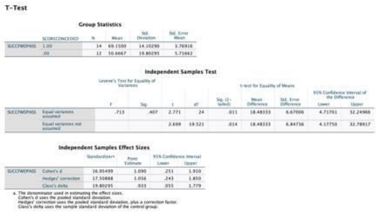


Tests of Normality

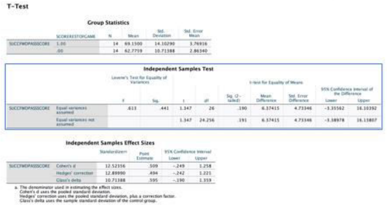
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SCORECONCEDED	.	12	.	.	12	.
SUCCFWDPASS	.263	12	.022	.916	12	.253
SUCCFWDPASSFULLGAME	.304	12	.003	.736	12	.002
SCORERESTOFGAME	.	12	.	.	12	.
SUCCFWDPASSSCORE	.263	12	.022	.916	12	.253
CONCEDERESTOFGAME	.	12	.	.	12	.
SUCCFWDPASSCONC	.181	12	.200*	.962	12	.811
SCORE	.263	12	.022	.916	12	.253
FULLMATCH	.304	12	.003	.737	12	.002
CONCEDE	.181	12	.200*	.962	12	.811
FULLMATCHCONC	.297	12	.004	.807	12	.011

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

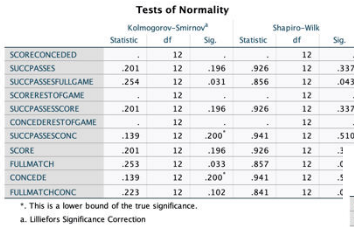


T-Test



T-Test

7. % Successful Passes

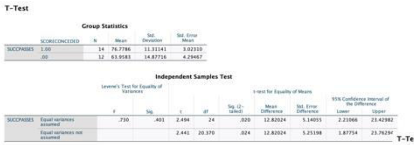


Tests of Normality

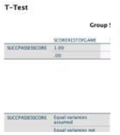
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SCORECONCEDED	.	12	.	.	12	.
SUCCPASSES	.201	12	.196	.926	12	.337
SUCCPASSESFULLGAME	.254	12	.031	.856	12	.043
SCORERESTOFGAME	.	12	.	.	12	.
SUCCPASSESSCORE	.201	12	.196	.926	12	.337
CONCEDERESTOFGAME	.	12	.	.	12	.
SUCCPASSESCONC	.139	12	.200*	.941	12	.510
SCORE	.201	12	.196	.926	12	.3
FULLMATCH	.253	12	.033	.857	12	.0
CONCEDE	.139	12	.200*	.941	12	.5
FULLMATCHCONC	.223	12	.102	.841	12	.0

*. This is a lower bound of the true significance.

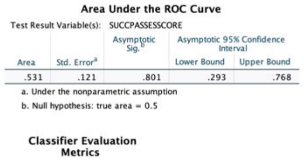
a. Lilliefors Significance Correction



T-Test



T-Test



Area Under the ROC Curve

Test Result Variable(s): SUCCPASSESSCORE

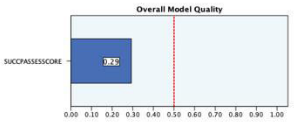
Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.531	.121	.801	.293	.768

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

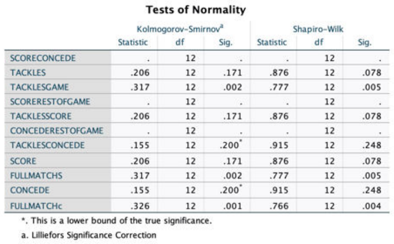
Classifier Evaluation Metrics

Test Result Variable(s): SUCCPASSESSCORE



Overall Model Quality

8. % Tackles Won

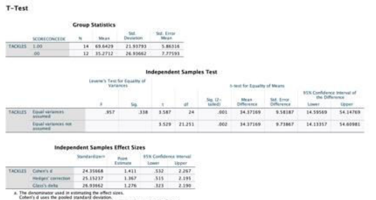


Tests of Normality

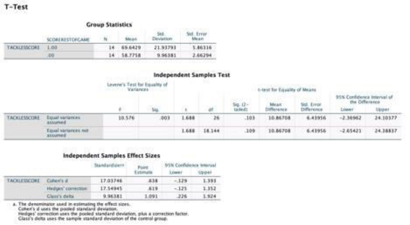
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SCORECONCEDE	.	12	.	.	12	.
TACKLES	.206	12	.171	.876	12	.078
TACKLESGAME	.317	12	.002	.777	12	.005
SCORERESTOFGAME	.	12	.	.	12	.
TACKLESSCORE	.206	12	.171	.876	12	.078
CONCEDERESTOFGAME	.	12	.	.	12	.
TACKLESCONCEDE	.155	12	.200*	.915	12	.248
SCORE	.206	12	.171	.876	12	.078
FULLMATCHS	.317	12	.002	.777	12	.005
CONCEDE	.155	12	.200*	.915	12	.248
FULLMATCHc	.326	12	.001	.766	12	.004

*. This is a lower bound of the true significance.

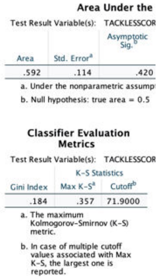
a. Lilliefors Significance Correction



T-Test



T-Test



Area Under the

Test Result Variable(s): TACKLESSCOR

Area	Std. Error[a]	Asymptotic Sig.[b]
.592	.114	.420

a. Under the nonparametric assump

b. Null hypothesis: true area = 0.5

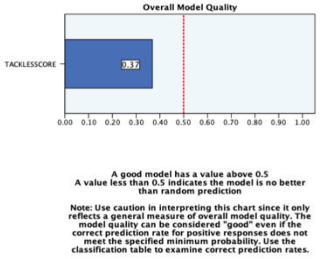
Classifier Evaluation Metrics

Test Result Variable(s): TACKLESSCOR

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
.184	.357	71.9000

a. The maximum Kolmogorov-Smirnov (K-S) metric.

b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



Overall Model Quality

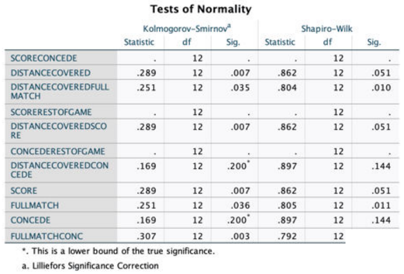
A good model has a value above 0.5
A value less than 0.5 indicates the model is no better than random prediction

Note: Use caution in interpreting this chart since it only reflects a general measure of overall model quality. The model quality can be considered "good" even if the correct prediction rate for positive responses does not meet the specified minimum probability. Use the classification table to examine correct prediction rates.

<u>**Absolute Parameters – Goals Scored**</u>

Figures reading from left to right; Normality Output, Goal Scored vs. Goal Conceded t-test, Goals Scored T-Tests, Area under ROC Curve Outputs and Overall Model Quality Outputs

9. Distance Covered

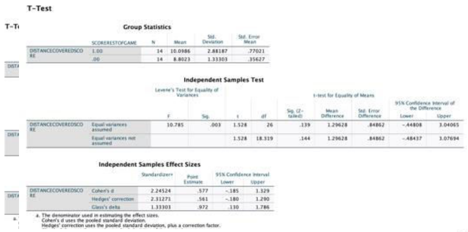


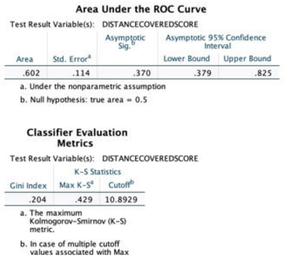
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SCORECONCEDE	.	12	.	.	12	.
DISTANCECOVERED	.289	12	.007	.862	12	.051
DISTANCECOVEREDFULLMATCH	.251	12	.035	.804	12	.010
SCORERESTOFGAME	.	12	.	.	12	.
DISTANCECOVEREDSCORE	.289	12	.007	.862	12	.051
CONCEDERESTOFGAME	.	12	.	.	12	.
DISTANCECOVEREDCONCEDE	.169	12	.200*	.897	12	.144
SCORE	.289	12	.007	.862	12	.051
FULLMATCH	.251	12	.036	.805	12	.011
CONCEDE	.169	12	.200*	.897	12	.144
FULLMATCHCONC	.307	12	.003	.792	12	

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction





Area Under the ROC Curve

Test Result Variable(s): DISTANCECOVEREDSCORE

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval Lower Bound	Upper Bound
.602	.114	.370	.379	.825

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

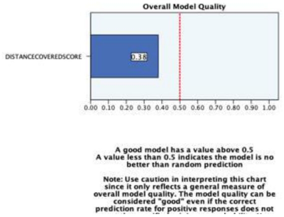
Classifier Evaluation Metrics

Test Result Variable(s): DISTANCECOVEREDSCORE

Gini Index	K-S Statistics Max K-S[a]	Cutoff[b]
.204	.429	10.8929

a. The maximum Kolmogorov-Smirnov (K-S) metric.

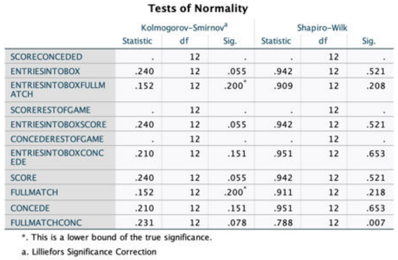
b. In case of multiple cutoff values associated with Max



A good model has a value above 0.5
A value less than 0.5 indicates the model is no better than random prediction

Note: Use caution in interpreting this chart since it only reflects a general measure of overall model quality. The model quality can be considered "good" even if the correct prediction rate for positive responses does not

10. Entries into Penalty Area For

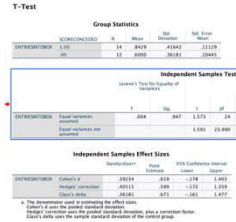


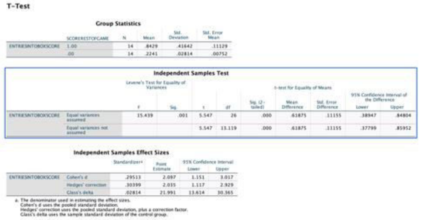
Tests of Normality

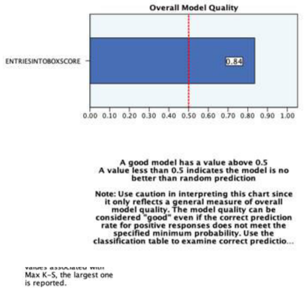
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SCORECONCEDED	.	12	.	.	12	.
ENTRIESINTOBOX	.240	12	.055	.942	12	.521
ENTRIESINTOBOXFULLMATCH	.152	12	.200*	.909	12	.208
SCORERESTOFGAME	.	12	.	.	12	.
ENTRIESINTOBOXSCORE	.240	12	.055	.942	12	.521
CONCEDERESTOFGAME	.	12	.	.	12	.
ENTRIESINTOBOXCONCEDE	.210	12	.151	.951	12	.653
SCORE	.240	12	.055	.942	12	.521
FULLMATCH	.152	12	.200*	.911	12	.218
CONCEDE	.210	12	.151	.951	12	.653
FULLMATCHCONC	.231	12	.078	.788	12	.007

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction







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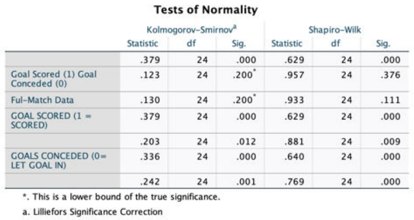
Note: Use caution in interpreting this chart since it only reflects a general measure of overall model quality. The model quality can be considered "good" even if the correct prediction rate for positive responses does not meet the specified minimum probability. Use the classification table to examine correct predictio...

Max K-S, the largest one is reported.

11. Number of Forward Passes

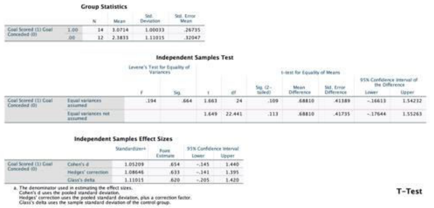


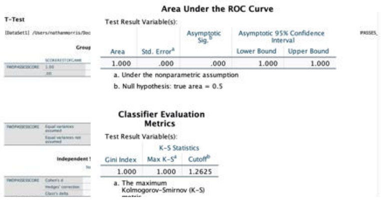
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
	.379	24	.000	.629	24	.000
Goal Scored (1) Goal Conceded (0)	.123	24	.200*	.957	24	.376
Ful-Match Data	.130	24	.200*	.933	24	.111
GOAL SCORED (1 = SCORED)	.379	24	.000	.629	24	.000
	.203	24	.012	.881	24	.009
GOALS CONCEDED (0= LET GOAL IN)	.336	24	.000	.640	24	.000
	.242	24	.001	.769	24	.000

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction





Area Under the ROC Curve

Test Result Variable(s):

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval Lower Bound	Upper Bound
1.000	.000	.000	1.000	1.000

a. Under the nonparametric assumption

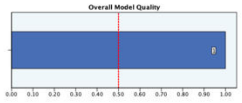
b. Null hypothesis: true area = 0.5

Classifier Evaluation Metrics

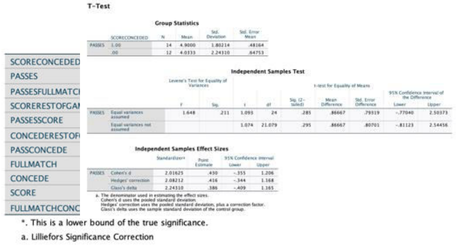
Test Result Variable(s):

Gini Index	K-S Statistics Max K-S[a]	Cutoff[b]
1.000	1.000	1.2625

a. The maximum Kolmogorov-Smirnov (K-S)

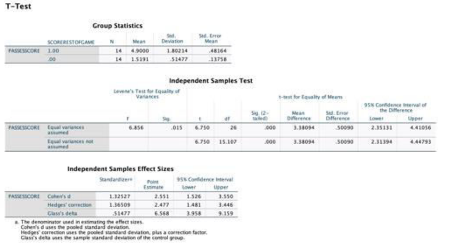


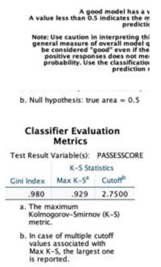
12. Number of Passes



*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction





b. Null hypothesis: true area = 0.5

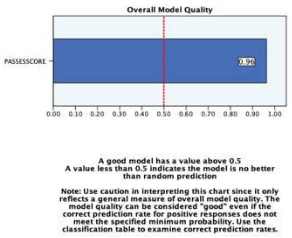
Classifier Evaluation Metrics

Test Result Variable(s): PASSESSCORE

Gini Index	K-S Statistics Max K-S[a]	Cutoff[b]
.980	.929	2.7500

a. The maximum Kolmogorov-Smirnov (K-S) metric.

b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



A good model has a value above 0.5
A value less than 0.5 indicates the model is no better than random prediction

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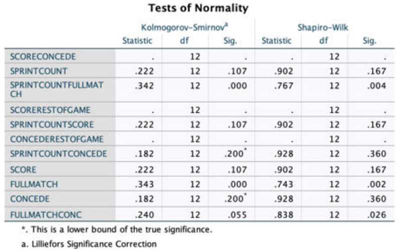
13. Sprint Count

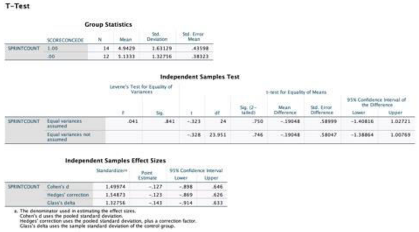


Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SCORECONCEDE	.	12	.	.	12	.
SPRINTCOUNT	.222	12	.107	.902	12	.167
SPRINTCOUNTFULLMATCH	.342	12	.000	.767	12	.004
SCORERESTOFGAME	.	12	.	.	12	.
SPRINTCOUNTSCORE	.222	12	.107	.902	12	.167
CONCEDERESTOFGAME	.	12	.	.	12	.
SPRINTCOUNTCONCEDE	.182	12	.200*	.928	12	.360
SCORE	.222	12	.107	.902	12	.167
FULLMATCH	.343	12	.000	.743	12	.002
CONCEDE	.182	12	.200*	.928	12	.360
FULLMATCHCONC	.240	12	.055	.838	12	.026

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction



T-Test

Group Statistics

	SCORECONCEDE	N	Mean	Std. Deviation	Std. Error Mean
SPRINTCOUNT	1.00	14	4.9429	1.63129	.43598
	.00	12	5.1333	1.32756	.38323

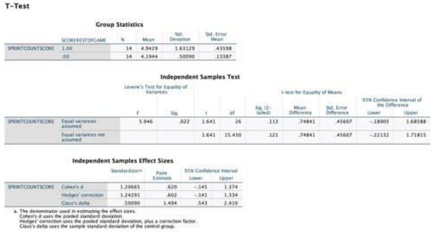
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SPRINTCOUNT	Equal variances assumed	.041	.841	-.323	24	.750	-.19048	.58999	-1.40816	1.02721
	Equal variances not assumed			-.328	23.951	.746	-.19048	.58047	-1.38864	1.00769

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
SPRINTCOUNT	Cohen's d	1.49974	-.127	-.898	.646
	Hedges' correction	1.54873	-.123	-.869	.626
	Glass's delta	1.32756	-.143	-.914	.633

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



T-Test

Group Statistics

	SCORERESTOFGAME	N	Mean	Std. Deviation	Std. Error Mean
SPRINTCOUNTSCORE	1.00	14	4.9429	1.63129	.43598
	.00	14	4.1944	.50090	.13387

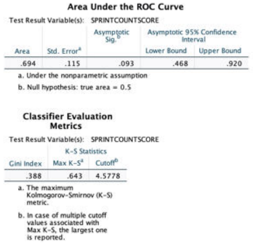
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SPRINTCOUNTSCORE	Equal variances assumed	5.946	.022	1.641	26	.113	.74841	.45607	-.18905	1.68588
	Equal variances not assumed			1.641	15.430	.121	.74841	.45607	-.22132	1.71815

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
SPRINTCOUNTSCORE	Cohen's d	1.20665	.620	-.145	1.374
	Hedges' correction	1.24291	.602	-.141	1.334
	Glass's delta	.50090	1.494	.543	2.410

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



Area Under the ROC Curve

Test Result Variable(s): SPRINTCOUNTSCORE

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.694	.115	.093	.468	.920

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

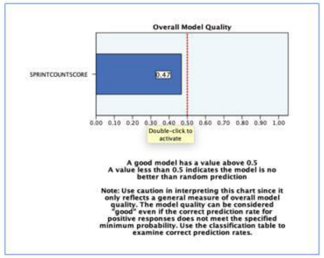
Classifier Evaluation Metrics

Test Result Variable(s): SPRINTCOUNTSCORE

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
.388	.643	4.5778

a. The maximum Kolmogorov-Smirnov (K-S) metric.

b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



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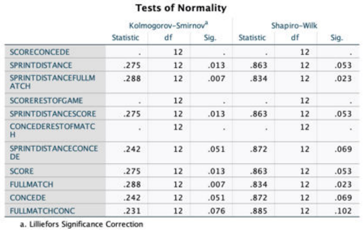
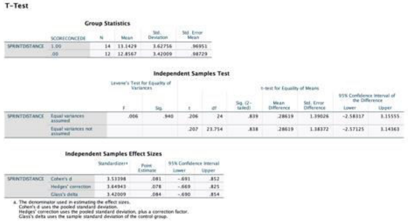
14. Sprint Distance



Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SCORECONCEDE	.	12	.	.	12	.
SPRINTDISTANCE	.275	12	.013	.863	12	.053
SPRINTDISTANCEFULLMATCH	.288	12	.007	.834	12	.023
SCORERESTOFGAME	.	12	.	.	12	.
SPRINTDISTANCESCORE	.275	12	.013	.863	12	.053
CONCEDERESTOFMATCH	.	12	.	.	12	.
SPRINTDISTANCECONCEDE	.242	12	.051	.872	12	.069
SCORE	.275	12	.013	.863	12	.053
FULLMATCH	.288	12	.007	.834	12	.023
CONCEDE	.242	12	.051	.872	12	.069
FULLMATCHCONC	.231	12	.076	.885	12	.102

a. Lilliefors Significance Correction



T-Test

Group Statistics

	SCORECONCEDE	N	Mean	Std. Deviation	Std. Error Mean
SPRINTDISTANCE	1.00	14	13.1429	3.62756	.96951
	.00	12	12.8567	3.42009	.98729

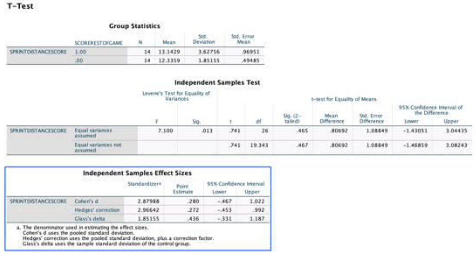
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SPRINTDISTANCE	Equal variances assumed	.006	.940	.206	24	.839	.28619	1.39026	-2.58317	3.15555
	Equal variances not assumed			.207	23.754	.838	.28619	1.38372	-2.57125	3.14363

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
SPRINTDISTANCE	Cohen's d	3.53398	.081	-.691	.852
	Hedges' correction	3.64943	.078	-.669	.825
	Glass's delta	3.42009	.084	-.690	.854

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



T-Test

Group Statistics

	SCORERESTOFGAME	N	Mean	Std. Deviation	Std. Error Mean
SPRINTDISTANCESCORE	1.00	14	13.1429	3.62756	.96951
	.00	14	12.3359	1.85155	.49485

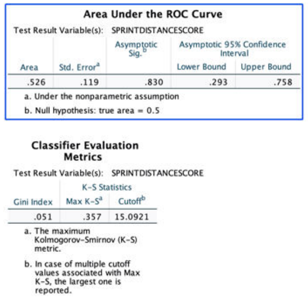
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SPRINTDISTANCESCORE	Equal variances assumed	7.100	.013	.741	26	.465	.80692	1.08849	-1.43051	3.04435
	Equal variances not assumed			.741	19.343	.467	.80692	1.08849	-1.46859	3.08243

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
SPRINTDISTANCESCORE	Cohen's d	2.87988	.280	-.467	1.022
	Hedges' correction	2.96642	.272	-.453	.992
	Glass's delta	1.85155	.436	-.331	1.187

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



Area Under the ROC Curve

Test Result Variable(s): SPRINTDISTANCESCORE

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.526	.119	.830	.293	.758

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

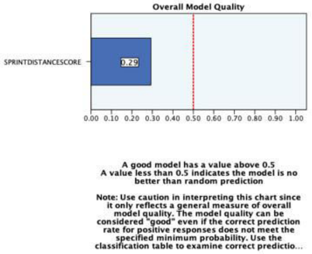
Classifier Evaluation Metrics

Test Result Variable(s): SPRINTDISTANCESCORE

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
.051	.357	15.0921

a. The maximum Kolmogorov-Smirnov (K-S) metric.

b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



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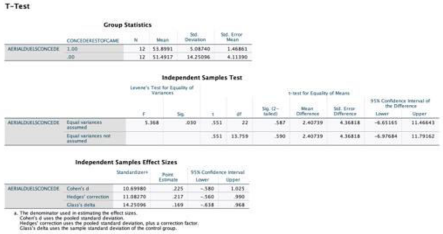
<u>Percentage Parameters – Goals Conceded</u>

Figures reading from left to right; Goals Conceded T-Tests, Area under ROC Curve Outputs and Overall Model Quality Outputs

15. % Aerial Duels Won



T-Test

Group Statistics

	CONCEDERESTOFGAME	N	Mean	Std. Deviation	Std. Error Mean
AERIALDUELSCONCEDE	1.00	12	53.8991	5.08740	1.46861
	.00	12	51.4917	14.25096	4.11390

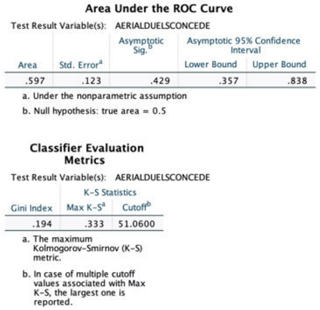
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
AERIALDUELSCONCEDE	Equal variances assumed	5.368	.030	.551	22	.587	2.40739	4.36818	-6.65165	11.46643
	Equal variances not assumed			.551	13.759	.590	2.40739	4.36818	-6.97684	11.79162

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
AERIALDUELSCONCEDE	Cohen's d	10.69980	.225	-.580	1.025
	Hedges' correction	11.08270	.217	-.560	.990
	Glass's delta	14.25096	.169	-.638	.968

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



Area Under the ROC Curve

Test Result Variable(s): AERIALDUELSCONCEDE

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.597	.123	.429	.357	.838

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

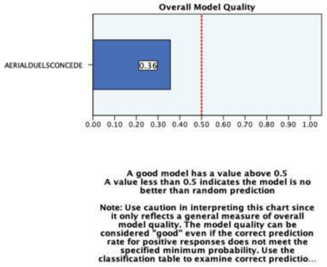
Classifier Evaluation Metrics

Test Result Variable(s): AERIALDUELSCONCEDE

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
.194	.333	51.0600

a. The maximum Kolmogorov-Smirnov (K-S) metric.

b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



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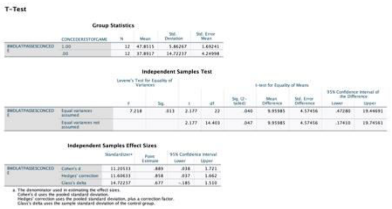
16. % BWD/LAT Passes



T-Test

Group Statistics

	CONCEDERESTOFGAME	N	Mean	Std. Deviation	Std. Error Mean
BWDLATPASSESCONCEDE	1.00	12	47.8515	5.86267	1.69241
	.00	12	37.8917	14.72237	4.24998

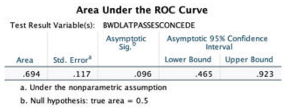
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
BWDLATPASSESCONCEDE	Equal variances assumed	7.218	.013	2.177	22	.040	9.95985	4.57456	.47280	19.44691
	Equal variances not assumed			2.177	14.403	.047	9.95985	4.57456	.17410	19.74561

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
BWDLATPASSESCONCEDE	Cohen's d	11.20533	.889	.038	1.721
	Hedges' correction	11.60633	.858	.037	1.662
	Glass's delta	14.72237	.677	-.185	1.510

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



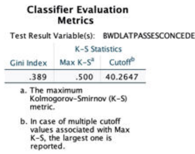
Area Under the ROC Curve

Test Result Variable(s): BWDLATPASSESCONCEDE

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.694	.117	.096	.465	.923

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5



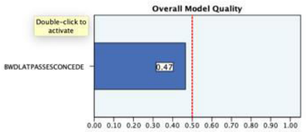
Classifier Evaluation Metrics

Test Result Variable(s): BWDLATPASSESCONCEDE

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
.389	.500	40.2647

a. The maximum Kolmogorov-Smirnov (K-S) metric.

b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



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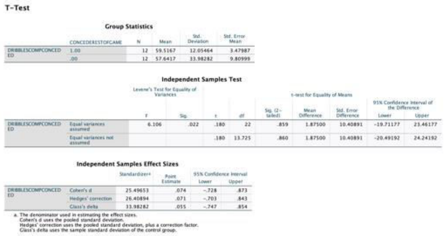
17. % Dribbles Completed



T-Test

Group Statistics

	CONCEDERESTOFGAME	N	Mean	Std. Deviation	Std. Error Mean
DRIBBLESCOMPCONCEDED	1.00	12	59.5167	12.05464	3.47987
	.00	12	57.6417	33.98282	9.80999

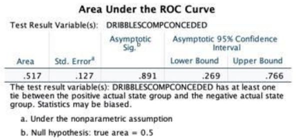
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
DRIBBLESCOMPCONCEDED	Equal variances assumed	6.106	.022	.180	22	.859	1.87500	10.40891	-19.71177	23.46177
	Equal variances not assumed			.180	13.725	.860	1.87500	10.40891	-20.49192	24.24192

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
DRIBBLESCOMPCONCEDED	Cohen's d	25.49653	.074	-.728	.873
	Hedges' correction	26.40894	.071	-.703	.843
	Glass's delta	33.98282	.055	-.747	.854

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



Area Under the ROC Curve

Test Result Variable(s): DRIBBLESCOMPCONCEDED

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.517	.127	.891	.269	.766

The test result variable(s): DRIBBLESCOMPCONCEDED has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

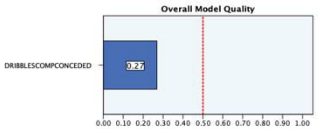
Classifier Evaluation Metrics

Test Result Variable(s): DRIBBLESCOMPCONCEDED

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
.035	.333	51.3000

a. The maximum Kolmogorov-Smirnov (K-S) metric.

b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



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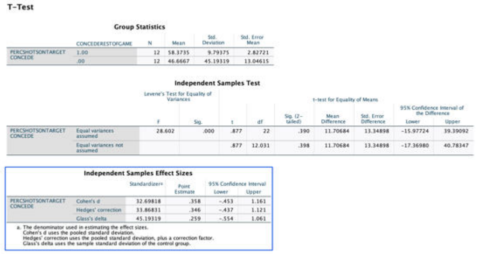
18. % Shot On Target



T-Test

Group Statistics

	CONCEDERESTOFGAME	N	Mean	Std. Deviation	Std. Error Mean
PERCSHOTSONTARGETCONCEDE	1.00	12	58.3735	9.79375	2.82721
	.00	12	46.6667	45.19319	13.04615

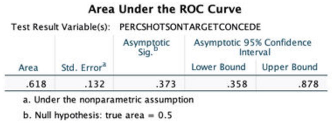
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PERCSHOTSONTARGETCONCEDE	Equal variances assumed	28.602	.000	.877	22	.390	11.70684	13.34898	-15.97724	39.39092
	Equal variances not assumed			.877	12.031	.398	11.70684	13.34898	-17.36980	40.78347

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
PERCSHOTSONTARGETCONCEDE	Cohen's d	32.69818	.358	-.453	1.161
	Hedges' correction	33.86831	.346	-.437	1.121
	Glass's delta	45.19319	.259	-.554	1.061

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



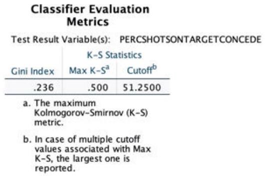
Area Under the ROC Curve

Test Result Variable(s): PERCSHOTSONTARGETCONCEDE

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.618	.132	.373	.358	.878

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5



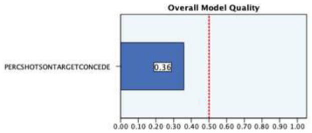
Classifier Evaluation Metrics

Test Result Variable(s): PERCSHOTSONTARGETCONCEDE

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
.236	.500	51.2500

a. The maximum Kolmogorov-Smirnov (K-S) metric.

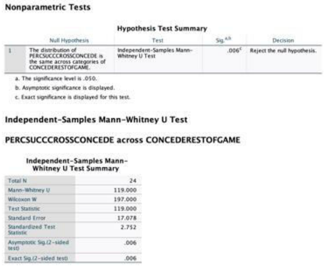
b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



A good model has a value above 0.5
A value less than 0.5 indicates the model is no better than random prediction

Note: Use caution in interpreting this chart since it only reflects a general measure of overall model quality. The model quality can be considered "good" even if the correct prediction rate for positive responses does not meet the specified minimum probability. Use the ...

19. % Successful Crosses



Nonparametric Tests

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distribution of PERCSUCCCROSSCONCEDE is the same across categories of CONCEDERESTOFGAME.	Independent-Samples Mann-Whitney U Test	.006[c]	Reject the null hypothesis.

a. The significance level is .050.

b. Asymptotic significance is displayed.

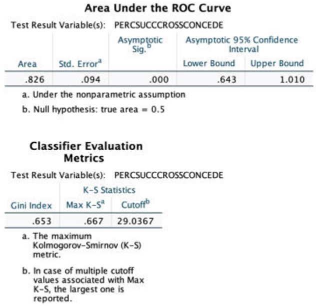
c. Exact significance is displayed for this test.

Independent-Samples Mann-Whitney U Test

PERCSUCCCROSSCONCEDE across CONCEDERESTOFGAME

Independent-Samples Mann-Whitney U Test Summary

Total N	24
Mann-Whitney U	119.000
Wilcoxon W	197.000
Test Statistic	119.000
Standard Error	17.078
Standardized Test Statistic	2.752
Asymptotic Sig.(2-sided test)	.006
Exact Sig.(2-sided test)	.006



Area Under the ROC Curve

Test Result Variable(s): PERCSUCCCROSSCONCEDE

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.826	.094	.000	.643	1.010

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

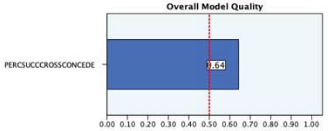
Classifier Evaluation Metrics

Test Result Variable(s): PERCSUCCCROSSCONCEDE

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
.653	.667	29.0367

a. The maximum Kolmogorov-Smirnov (K-S) metric.

b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



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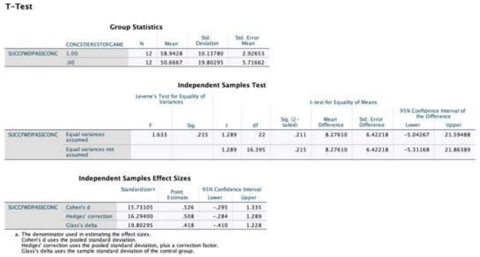
20. % Successful Forward Passes



T-Test

Group Statistics

	CONCEDERESTOFGAME	N	Mean	Std. Deviation	Std. Error Mean
SUCCFWDPASSCONC	1.00	12	58.9428	10.13780	2.92653
	.00	12	50.6667	19.80295	5.71662

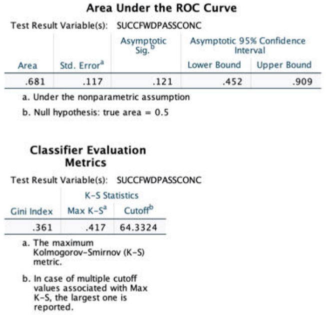
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SUCCFWDPASSCONC	Equal variances assumed	1.633	.215	1.289	22	.211	8.27610	6.42218	-5.04267	21.59488
	Equal variances not assumed			1.289	16.395	.215	8.27610	6.42218	-5.31168	21.86389

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
SUCCFWDPASSCONC	Cohen's d	15.73105	.526	-.295	1.335
	Hedges' correction	16.29400	.508	-.284	1.289
	Glass's delta	19.80295	.418	-.410	1.228

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



Area Under the ROC Curve

Test Result Variable(s): SUCCFWDPASSCONC

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.681	.117	.121	.452	.909

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

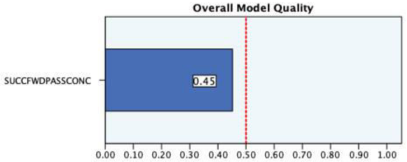
Classifier Evaluation Metrics

Test Result Variable(s): SUCCFWDPASSCONC

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
.361	.417	64.3324

a. The maximum Kolmogorov-Smirnov (K-S) metric.

b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



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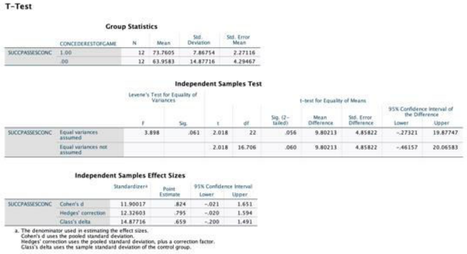
21. % Successful Passes



T-Test

Group Statistics

	CONCEDERESTOFGAME	N	Mean	Std. Deviation	Std. Error Mean
SUCCPASSESCONC	1.00	12	73.7605	7.86754	2.27116
	.00	12	63.9583	14.87716	4.29467

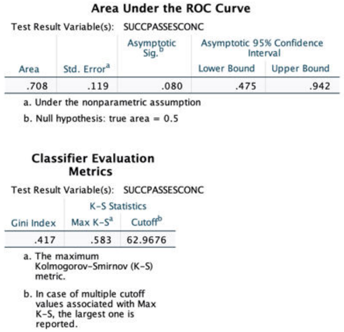
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SUCCPASSESCONC	Equal variances assumed	3.898	.061	2.018	22	.056	9.80213	4.85822	-.27321	19.87747
	Equal variances not assumed			2.018	16.706	.060	9.80213	4.85822	-.46157	20.06583

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
SUCCPASSESCONC	Cohen's d	11.90017	.824	-.021	1.651
	Hedges' correction	12.32603	.795	-.020	1.594
	Glass's delta	14.87716	.659	-.200	1.491

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



Area Under the ROC Curve

Test Result Variable(s): SUCCPASSESCONC

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.708	.119	.080	.475	.942

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

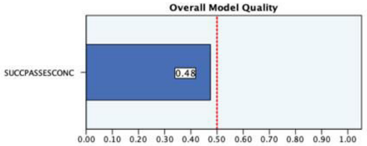
Classifier Evaluation Metrics

Test Result Variable(s): SUCCPASSESCONC

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
.417	.583	62.9676

a. The maximum Kolmogorov-Smirnov (K-S) metric.

b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



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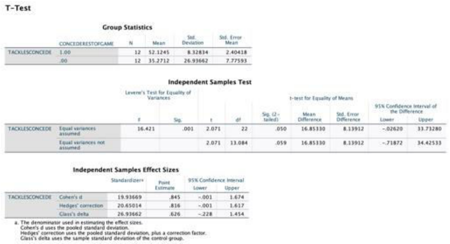
22. % Tackles Won



T-Test

Group Statistics

	CONCEDERESTOFGAME	N	Mean	Std. Deviation	Std. Error Mean
TACKLESCONCEDE	1.00	12	52.1245	8.32834	2.40418
	.00	12	35.2712	26.93662	7.77593

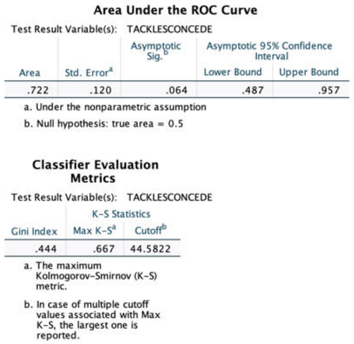
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
TACKLESCONCEDE	Equal variances assumed	16.421	.001	2.071	22	.050	16.85330	8.13912	-.02620	33.73280
	Equal variances not assumed			2.071	13.084	.059	16.85330	8.13912	-.71872	34.42533

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
TACKLESCONCEDE	Cohen's d	19.93669	.845	-.001	1.674
	Hedges' correction	20.65014	.816	-.001	1.617
	Glass's delta	26.93662	.626	-.228	1.454

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



Area Under the ROC Curve

Test Result Variable(s): TACKLESCONCEDE

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.722	.120	.064	.487	.957

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

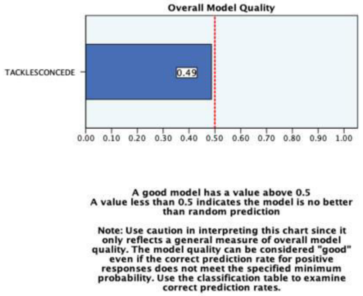
Classifier Evaluation Metrics

Test Result Variable(s): TACKLESCONCEDE

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
.444	.667	44.5822

a. The maximum Kolmogorov-Smirnov (K-S) metric.

b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



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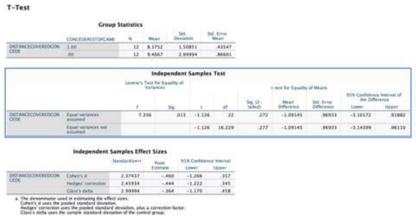
Absolute Parameters – Goals Conceded

Figures reading from left to right; Goals Conceded T-Tests, Area under ROC Curve Outputs and Overall Model Quality Outputs

23. Distance Covered



T-Test

Group Statistics

	CONCEDERESTOFGAME	N	Mean	Std. Deviation	Std. Error Mean
DISTANCECOVEREDCONCEDE	1.00	12	8.3752	1.50851	.43547
	.00	12	9.4667	2.99994	.86601

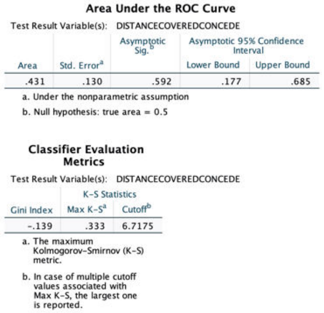
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
DISTANCECOVEREDCONCEDE	Equal variances assumed	7.336	.013	-1.126	22	.272	-1.09145	.96933	-3.10172	.91882
	Equal variances not assumed			-1.126	16.229	.277	-1.09145	.96933	-3.14399	.96110

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
DISTANCECOVEREDCONCEDE	Cohen's d	2.37437	-.460	-1.266	.357
	Hedges' correction	2.45934	-.444	-1.222	.345
	Glass's delta	2.99994	-.364	-1.170	.458

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



Area Under the ROC Curve

Test Result Variable(s): DISTANCECOVEREDCONCEDE

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.431	.130	.592	.177	.685

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

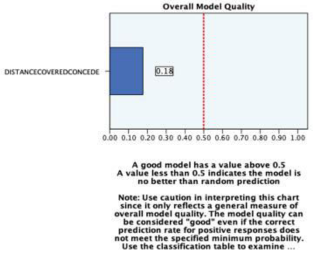
Classifier Evaluation Metrics

Test Result Variable(s): DISTANCECOVEREDCONCEDE

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
-.139	.333	6.7175

a. The maximum Kolmogorov-Smirnov (K-S) metric.

b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



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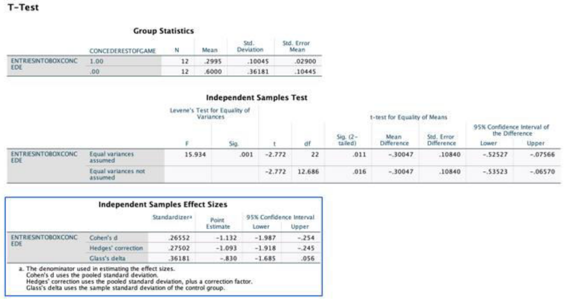
24. Entries into the Box For



T-Test

Group Statistics

	CONCEDERESTOFGAME	N	Mean	Std. Deviation	Std. Error Mean
ENTRIESINTOBOXCONCEDE	1.00	12	.2995	.10045	.02900
	.00	12	.6000	.36181	.10445

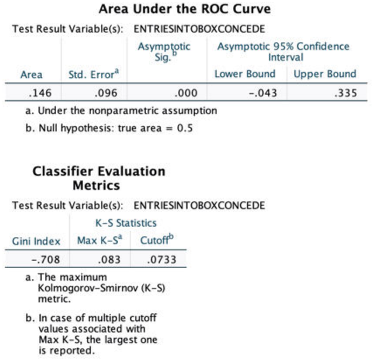
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
ENTRIESINTOBOXCONCEDE	Equal variances assumed	15.934	.001	-2.772	22	.011	-.30047	.10840	-.52527	-.07566
	Equal variances not assumed			-2.772	12.686	.016	-.30047	.10840	-.53523	-.06570

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
ENTRIESINTOBOXCONCEDE	Cohen's d	.26552	-1.132	-1.987	-.254
	Hedges' correction	.27502	-1.093	-1.918	-.245
	Glass's delta	.36181	-.830	-1.685	.056

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



Area Under the ROC Curve

Test Result Variable(s): ENTRIESINTOBOXCONCEDE

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.146	.096	.000	-.043	.335

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

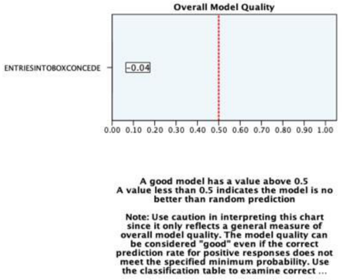
Classifier Evaluation Metrics

Test Result Variable(s): ENTRIESINTOBOXCONCEDE

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
-.708	.083	.0733

a. The maximum Kolmogorov-Smirnov (K-S) metric.

b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



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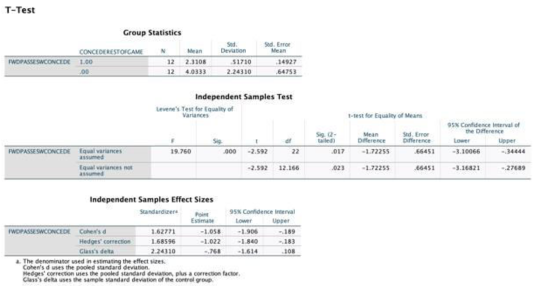
25. Number of Forward Passes



T-Test

Group Statistics

	CONCEDERESTOFGAME	N	Mean	Std. Deviation	Std. Error Mean
FWDPASSESWCONCEDE	1.00	12	2.3108	.51710	.14927
	.00	12	4.0333	2.24310	.64753

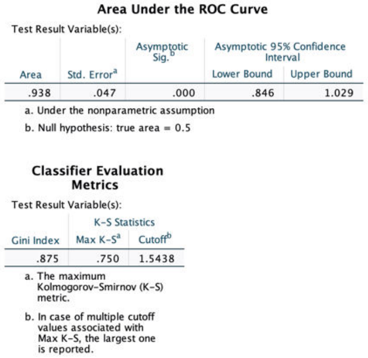
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
FWDPASSESWCONCEDE	Equal variances assumed	19.760	.000	-2.592	22	.017	-1.72255	.66451	-3.10066	-.34444
	Equal variances not assumed			-2.592	12.166	.023	-1.72255	.66451	-3.16821	-.27689

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
FWDPASSESWCONCEDE	Cohen's d	1.62771	-1.058	-1.906	-.189
	Hedges' correction	1.68596	-1.022	-1.840	-.183
	Glass's delta	2.24310	-.768	-1.614	.108

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



Area Under the ROC Curve

Test Result Variable(s):

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.938	.047	.000	.846	1.029

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

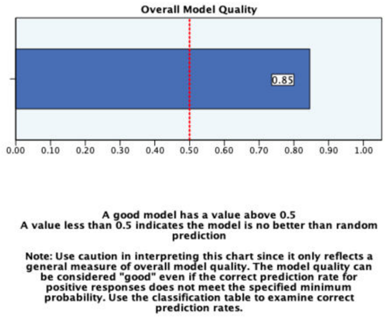
Classifier Evaluation Metrics

Test Result Variable(s):

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
.875	.750	1.5438

a. The maximum Kolmogorov-Smirnov (K-S) metric.

b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



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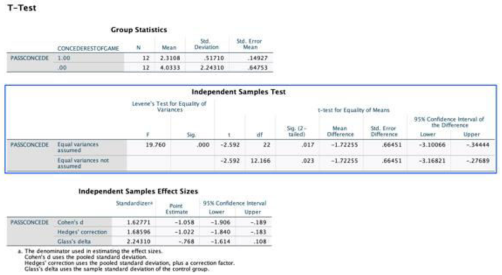
26. Number of Passes



T-Test

Group Statistics

	CONCEDERESTOFGAME	N	Mean	Std. Deviation	Std. Error Mean
PASSCONCEDE	1.00	12	2.3108	.51710	.14927
	.00	12	4.0333	2.24310	.64753

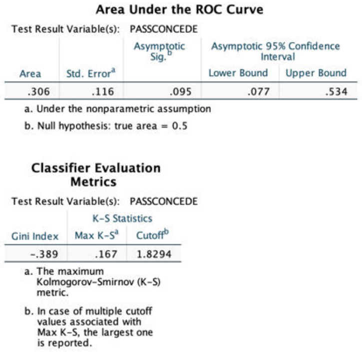
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PASSCONCEDE	Equal variances assumed	19.760	.000	-2.592	22	.017	-1.72255	.66451	-3.10066	-.34444
	Equal variances not assumed			-2.592	12.166	.023	-1.72255	.66451	-3.16821	-.27689

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
PASSCONCEDE	Cohen's d	1.62771	-1.058	-1.906	-.189
	Hedges' correction	1.68596	-1.022	-1.840	-.183
	Glass's delta	2.24310	-.768	-1.614	.108

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



Area Under the ROC Curve

Test Result Variable(s): PASSCONCEDE

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.306	.116	.095	.077	.534

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

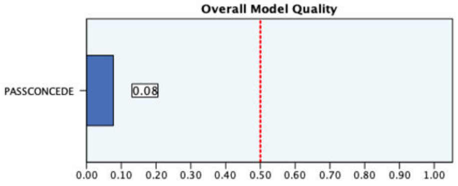
Classifier Evaluation Metrics

Test Result Variable(s): PASSCONCEDE

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
-.389	.167	1.8294

a. The maximum Kolmogorov-Smirnov (K-S) metric.

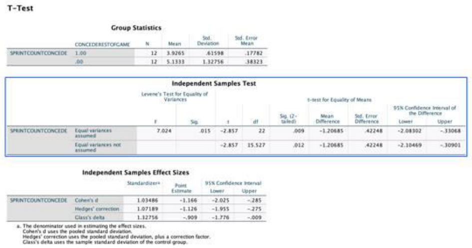
b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



A good model has a value above 0.5
A value less than 0.5 indicates the model is no better than random prediction

Note: Use caution in interpreting this chart since it only reflects a general measure of overall model quality. The model quality can be considered "good" even if the correct prediction rate for positive responses does not meet the specified minimum probability. Use the classification table to examine correct prediction rates.

27. Sprint Count



T-Test

Group Statistics

	CONCEDERESTOFGAME	N	Mean	Std. Deviation	Std. Error Mean
SPRINTCOUNTCONCEDE	1.00	12	3.9265	.61598	.17782
	.00	12	5.1333	1.32756	.38323

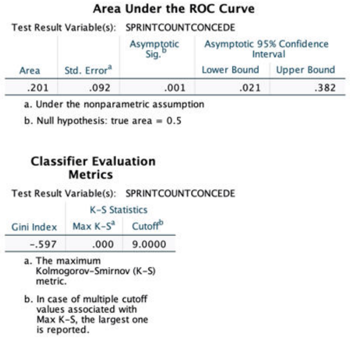
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SPRINTCOUNTCONCEDE	Equal variances assumed	7.024	.015	-2.857	22	.009	-1.20685	.42248	-2.08302	-.33068
	Equal variances not assumed			-2.857	15.527	.012	-1.20685	.42248	-2.10469	-.30901

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
SPRINTCOUNTCONCEDE	Cohen's d	1.03486	-1.166	-2.025	-.285
	Hedges' correction	1.07189	-1.126	-1.955	-.275
	Glass's delta	1.32756	-.909	-1.776	-.009

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



Area Under the ROC Curve

Test Result Variable(s): SPRINTCOUNTCONCEDE

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.201	.092	.001	.021	.382

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

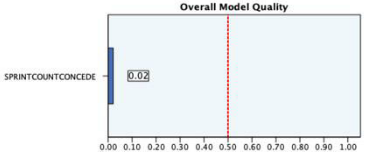
Classifier Evaluation Metrics

Test Result Variable(s): SPRINTCOUNTCONCEDE

Gini Index	K-S Statistics	
	Max K-S[a]	Cutoff[b]
-.597	.000	9.0000

a. The maximum Kolmogorov-Smirnov (K-S) metric.

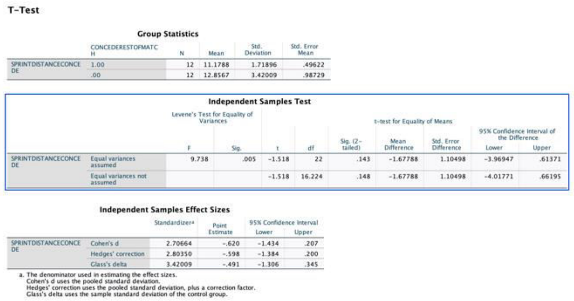
b. In case of multiple cutoff values associated with Max K-S, the largest one is reported.



A good model has a value above 0.5
A value less than 0.5 indicates the model is no better than random prediction

Note: Use caution in interpreting this chart since it only reflects a general measure of overall model quality. The model quality can be considered "good" even if the correct prediction rate for positive responses does not meet the specified minimum probability. Use the classification table to examine cor

28. Sprint Distance



T-Test

Group Statistics

	CONCEDERESTOFMATCH	N	Mean	Std. Deviation	Std. Error Mean
SPRINTDISTANCECONCEDE	1.00	12	11.1788	1.71896	.49622
	.00	12	12.8567	3.42009	.98729

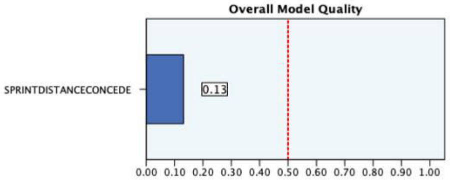
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SPRINTDISTANCECONCEDE	Equal variances assumed	9.738	.005	-1.518	22	.143	-1.67788	1.10498	-3.96947	.61371
	Equal variances not assumed			-1.518	16.224	.148	-1.67788	1.10498	-4.01771	.66195

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
SPRINTDISTANCECONCEDE	Cohen's d	2.70664	-.620	-1.434	.207
	Hedges' correction	2.80350	-.598	-1.384	.200
	Glass's delta	3.42009	-.491	-1.306	.345

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.



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Note: Use caution in interpreting this chart since it only reflects a general measure of overall model quality. The model quality can be considered "good" even if the correct prediction rate for positive responses does not meet the specified minimum probability. Use the classification table to examine correct ...