



PHD

Performance Health Management in English Professional Football A Mixed Method Study

Odetoyinbo, Kunle

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Performance Health Management in English Professional Football
A Mixed Method Study

Kunle Odetoyinbo

A thesis submitted in part fulfilment for the award
Professional Doctorate in Health

University of Bath

Department of Health

2019

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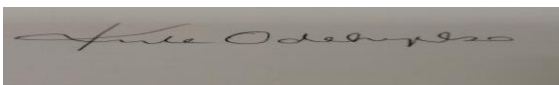
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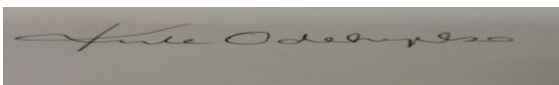
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Abstract

Background Teamwork effectiveness studies illustrate that multi-disciplinary teams working in highly pressured environments can produce sub-optimal outcomes from their work without due consideration of their team's structure and processes. In professional football, multi-disciplinary performance and healthcare teams (PHCTs) are increasingly being employed to risk-manage football squads in a highly challenging, fast paced and competitive environment. To date, the teamwork effectiveness of PHCTs remains unknown.

Aim Using the framework of an adapted Integrated Team Effectiveness Model (ITEM), this study sought to determine whether the structures and processes adopted by a PHCT in the English Championship football league, predicted an outcome of their work, namely, the number of players available (PA) for competition during varying match frequencies.

Design A sequential explanatory mixed method case study

Method: A team process, followed by team structure questionnaire and focus group discussion, were administered during and after the season respectively, to full-time practitioners involved in the delivery of performance and health support services. Match frequency and the number of players available for each match were also recorded, where ≤ 3 days recovery between matches was considered to represent "match congestion". The reported data were analysed using Pearson correlation and content or framework analysis where, the qualitative data was used to further inform the quantitative findings.

Results Player availability (PA) over the course of 39 matches averaged $80.6 \pm 4.9\%$ (range 75-89%) during which the PHCT had an average of five days (SD=4, range 2-14) between matches to apply their work. However, for 16 of 28 weeks investigated, preparation took place during match congested periods. During match congestion, $78.1 \pm 3.2\%$ of the squad were available for selection compared with 84.2 ± 4.7 outside of these periods, supported by a strong positive correlation between match frequency and PA [$r = -0.68$; 95% BCa (.324, .929) $p = 0.008$]. Interdisciplinary as opposed to multidisciplinary teamwork processes in meetings were associated with more players being available for competition where the PHCT's 'teamwork approach' had a moderately strong correlation with PA [$r = 0.53$; BCa 95% (.087, .888) $p = 0.035$]. The higher the number of meetings [$r = 0.46$; BCa 95% (.219, .821) $p = 0.048$] and the more satisfaction that PHCT members had with those meetings [$r = -0.41$; BCa 95% (.042, .714) $p = 0.043$] were both associated with higher numbers of players being available for competition. Similarly, the more PHCT staff evaluated of their work and provided feedback for innovation and change, there was a tendency for more of the squad members to be ready for match selection [$r = -0.44$; BCa 95% (.374, .878) $p = 0.009$]. PHCT members interacting negatively towards one another through communicated behaviour, opinions and suggestions during meetings was associated with lower PA [$r = -0.57$; BCa 95% (-.087, -.097) $p = 0.03$].

PHCT working relationships were conceptualised as a 'structured interdependency' to reflect important structural aspects of their team which were associated with shared practices focused on optimising PA and winning the next game. A certain degree of disruption to 'interdependent working' because of human resource and team premises challenges were evident during match congested periods. This resulted in multidisciplinary rather than interdisciplinary processes being adopted in meetings, contributing to the relationships between PHCT processes and PA.

Conclusion: This study is the first to illustrate that the structure and processes adopted by a PHCT in professional football during varied match frequencies are related to the number of players available for competition. The PHCT's structure further informed an understanding of these relationships where match frequency was strongly associated with the availability of players for competition. This research provided a unique perspective of the teamwork factors, using the framework of an ITEM, to reveal important aspects of performance and health management in a professional football club.

Acknowledgements

My research journey and professional practice have been supported by interactions with many friends and colleagues, some hard work and associated good fortune. Recognition must therefore extend to a great number of people who have shared in my formal/informal education and professional sport endeavours, particularly over the last three decades. I am deeply grateful therefore to the many coaches, teachers and colleagues who have shared a love of professional sport, exercise and or health with me and whom inherently shape so many aspects of this thesis.

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I am especially grateful to the research participants that not only allowed access to their stressful working environments but were able to endure the many months over which data was collected. I particularly recall my many visits to the football club when both internal and external pressures were high, yet significant amounts of data to support this thesis were returned, for which I am truly thankful.

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I also acknowledge my mother and late father's determination and sacrifices during my earlier years, which have shaped so much of what I have today. You have both encouraged me to believe in something bigger than our circumstances back then and forged the development of an ethos that hard work works, perseverance has its benefits and that lifelong education is a worthwhile investment.

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In this year 2019, may the challenges both inside and outside of elite sport, embrace teamwork and collaboration consistent with the themes in thesis.

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Glossary of Terms and Abbreviations

<i>Multi-disciplinary Team</i>	A group composed of a variety of professional from different disciplines. (Note difference with multidisciplinary teamwork approach below not in italics)
Teamwork	Behavioural processes (e.g. communication, collaboration, sharing of expertise) that practitioners use to accomplish independent or interdependent work and/or the affective, cognitive and motivation states that emerge during that work (e.g. cohesion)
Taskwork	Components of an individual team members performance that do not require interaction with other team members
Teamwork Effectiveness	The capacity of the team to achieve goals/objectives and or expectations set internally or by external stakeholders over a given period.
Teamwork Approaches	Defining a team's approach to achieving outcomes of their work that include;
Interdisciplinary	Teams of professionals from different disciplines who work towards shared goals and within a team structure (McCallin and Bamford, 2007)
*Multidisciplinary	Teams of professionals from different disciplines who work towards their own goals within a team structure.

Abbreviations

PH	Performance and Health
PHCT	Performance and Health Care Team
PA	Player Availability
MF	Match Frequency

Chapter 1. Introduction

Practitioners in professional sport including coaches, scientists and clinicians are constantly looking for ways to improve the performance and health (PH) of the players with whom they work. Optimal health provides the basis for consistent, uninterrupted training and the potential for high level performance. Despite the well referenced benefits of moderate exercise and physical activity to health (Russell, 2013), elite sport presents considerable health challenges to both the athletes and those charged with the responsibility of supporting them. This is particularly the case in male European professional football, where the occupational health risk posed by participation has been found to be 1000 times higher than high risk industrial occupations outside of sport (Drawer and Fuller, 2002). For example, in Europe's Champions League teams, with typical squads of 25 players, an average 50 time-loss injuries each season will be incurred, 16% of which can be severe and account for absence from competition (e.g., reduced PA), for more than four weeks (Bengtsson, Ekstrand and Hägglund, 2013a).

Muscle injuries are a particular problem in this regard and there is strong evidence to suggest that their incidence had climbed year on year for over 15 seasons in European league football (Ekstrand et al., 2013; Ekstrand, Waldén and Hägglund, 2016). These injuries are an important consideration for any football club because they account for more than one-third of all time-loss injuries and cause more than a quarter of all total unavailability of European football players (Ekstrand, 2011). The financial costs associated with a first team regular squad member being unavailable for one month through injury has been estimated to be around €500,000 to €600,000 per month or between €17,000 and €20,000 per day (Ekstrand, 2013a). For the most senior teams in the UEFA Champions League, unavailability of players due to injuries alone amounts to an average of €20 million per season, including both direct (treatment and diagnostics) and indirect (reduced availability) costs (Ekstrand, 2016).

Football squads with fewer injuries and more consistent, uninterrupted training have been shown to perform better and finish in higher final league positions at amateur (Ekstrand, 1983) and professional levels (Eiral et al., 2013). This makes injuries and the number of players available for competition a significant concern across a range of stakeholders including football club owners, coaches, governing bodies, media, sponsors and fans with shared interests in performance and economic outcomes.

Over the past two decades, the number, frequency and intensity of competitive fixtures in professional football has markedly increased (Barnes et al., 2014). In English professional football, where the season spans roughly 10 months of a calendar year, some teams in the top two divisions (Premiership and Championship) play in excess of 60 matches (Carling et al., 2012). In these leagues there are certain periods of the season where multiple matches will be played within a single week (e.g. 3 matches in 7-8 days), defined as "match congestion" that can sometimes continue over several weeks (Carling et al.,

2016). This has the potential to reduce both physical (Odetoyinbo et al. 2008) and technical performance (Dellal et al., 2015) as well as increase injury and associated health risks (Carling et al., 2016c; Häggglund et al., 2013). Up to 120 hours of recovery time between matches can be necessary to restore physiological disturbances that impact health and subsequent performance (Nédélec et al., 2013a). Therefore, some players may be at an elevated injury risk during congested periods, particularly when only 96 hours separates matches (Lago-Peñas et al., 2011) resulting in potential for reduced PA for imminent competition.

Given the enormity of these performance and health challenges, most football clubs no longer rely only on a team manager, coaching staff and limited number of medical personnel to influence health and team performance (Drust and Green, 2013). Instead, a range of practitioners are routinely employed within professional football clubs to form multi-disciplinary (composed of varied disciplines) support teams. These will most often include Sport and Exercise Medicine specialists (physicians, physiotherapists, sports scientists, nutritionists, strength & conditioning trainers) and other personnel (medical consultants, podiatrists, chiropractors, match analysts) that are either employed full-time within the football club or externally contracted to support the team on a part-time basis. Collectively these professionals, described hereafter as performance and healthcare teams (PHCTs), are charged with the responsibility of optimising players' ability to perform and managing their health and wellbeing using their collective expertise (Jaspers et al., 2016).

Like so many practitioners across a range of organisational domains, PHCTs are assembled based on individual technical abilities and professional specialisations (Malcolm and Scott, 2011a). Multi-disciplinary professionals working in groups and teams have at times proved problematic in a range of organisations including healthcare and aviation, where effective teamwork has been found to underpin the achievement of desired outcomes of collaborative work (Kozlowski and Ilgen, 2008) and suboptimal teamwork to have at times catastrophic results for outcomes of such work. Nevertheless, individuals with different skillsets frequently collaborate to enhance a collective team's performance and PHCTs provide an example where this is possible within the football context. Yet, despite their prevalence and growing importance, limited reference to these multi-disciplinary teams have been made in the football or sporting literature.

Whilst PHCTs have benefited from considerable scientific advances in the preparation for, participation in, and recovery from training and competition at a player level, limited evidence is available in the literature which describes or informs the teamwork practices that support the collective teamwork-based services they provide. This is somewhat contrary to the considerable amounts of research dedicated to teamwork effectiveness in a range of organisational studies outside of sport (Cohen and Bailey, 1997; Jaca et al., 2013).

Teamwork generally refers to behavioural processes (e.g. communication, collaboration, sharing of expertise) or non-technical skills that people use to

accomplish interdependent work and/or the affective, cognitive and motivation states (e.g., cohesion or conflict) that emerge during that work (Ilgen et al., 2005). Wide ranging teamwork research has typically been conducted using theoretically modelled arguments (Jaca et al., 2013). The evidence accrued from these studies indicates for multi-disciplinary teams to be effective, individual members must transcend professional barriers to engage in participative decision-making and interdisciplinary behaviours (Sutton et al., 2011; Heinemann, 2012). When teams of *multi-disciplinary* practitioners adopt this teamwork approach, they have been described as an 'interdisciplinary team', differentiated by their integration of knowledge and collaborative behaviours beyond that seen in 'multidisciplinary teams', where individuals work towards their own goals with limited interaction (Mullins et al., 2008). The relevance of these teamwork approaches to PHCTs in football is currently unknown, but the suggestion from these teamwork studies (Mirjam, 2009; Roncaglia, 2016; Salas et al., 2008) is that interdisciplinary approaches would be favourable for outcomes of PHCT work.

With limited reference to PHCTs in the literature, describing their processes as "collaborative", "multidisciplinary or interdisciplinary" might not be representative of the operational structures and processes that they choose to adopt in each football club. The fast paced, volatile and unpredictable professional football environment (McDougall, Nesti and Richardson, 2015) may result in PHCTs adopting a less effective 'reductionist model' where limited communication, partial integration and collaboration between disciplines occurs (Dijkstra et al., 2014). This may in part explain a significant amount of training and match-related time loss in football should the PHCT's teamwork approach be related to injury risk and management.

The Union of European Football Associations (UEFA) currently conducts an ongoing Elite Club injury study representing 55 football clubs from 19 countries. When the leading medical officers that work within these clubs were surveyed, they highlighted four significant challenges including the workload imposed on players, the quality of internal communications amongst staff, player wellbeing and the head coach's leadership style (Ekstrand, 2017). The common thread linking these highlighted concerns to the health of professional football players are that they are all, to varying degrees, controlled by the teamwork practices of the PHCT and coaching staff. Yet, these critical factors concerning PHCT activities, have received limited research attention to date and remain speculation.

The 'organisational context' of professional English football has been described as being rife with culturally-driven challenges that include interdepartmental communication problems, coach-athlete conflict, interference from owners, negative reporting in the media and staff being required to continually justify how their input impacts performance (Eubank et al, 2014). This creates a unique environment in which PHCTs must operate effectively, maintaining a responsibility to protect the short and long-term health of the players, balanced against the potentially competing demands of the head coach, whose priorities

are focussed on winning (Ashton, 2016). Consequently, the working relationships between support staff and coaching is an important consideration for the performance and health objectives of each football club.

A long history of theoretically guided framework research has resulted in considerable insights for a variety of industries including healthcare (Lemieux et al., 2002; McGrath, 1964). One such framework is the Integrated Team Effectiveness Model (ITEM; Lemieux-Charles and McGuire, 2006) which conceptualises relationships between multiple dimensions of a team's context, structure, processes and outcomes of its work. This model is popular in teamwork research because it recognises multiple dimensions of teams however, to our knowledge has never been applied to multi-disciplinary support teams in sport. It could be that the practitioners that comprise PHCTs in football meet the definition of teams considered in the creation of this framework which are described as 'a collection of individuals, interdependent in tasks, sharing responsibility for outcomes and being recognised by others both externally and internally as an intact social entity' (Cohen and Bailey (1997). Moreover, despite many models that outline key elements of teamwork effectiveness, ITEM is the only framework model to consider factors at systems (structure/processes), practice and organisational levels (Reeves et al., 2010). This refers to the effectiveness of teamwork being considered across the socio-political context in which the team exists, the organisational context in which the team is doing its work, the task design, team process and the psycho-social traits of the team. As a model it can therefore be tailored to football where PHCTs must integrate their work in a highly pressured environment.

This novel study therefore sought to investigate performance health management conducted by PHCTs, with specific reference to match congestion in an elite professional English football club. The aim was to gain a unique understanding of the PHCT's impact on PA. Adding further to the originality of this study, an adapted ITEM was used as a guiding framework to examine factors associated with outcomes of PHCT work, that have only been speculated upon in the literature. Given that research to date has largely focussed on performance and health factors at a player level, this study distinctly focussed on the systems namely structures and processes that underpin PHCT work. The considerations of teamwork factors within this study may have relevance to the success or failures within football clubs and, the governing bodies charged with promoting and protecting the wellbeing of players and the sport.

Chapter 2: Literature Review

2.1 Aim and scope of the literature review

This review of the literature illustrates research focussed on PH management in professional football considering the circumstances and context in which PHCTs conduct their work, specific tasks they perform and teamwork effectiveness studies that have relevance to their practice.

2.11 The Professional Football Working Environment

Association football is played in almost every country with such popularity that it can capture global audiences that reach 45% of the world's population during major professional competitions (Conrad, 2015). The English football leagues are the most watched, highest resourced and culturally diverse worldwide (Wheeler, 2017). This is evident in movement capital (the football players) across national borders and the wide array of international companies and organisations involved in ownership, sponsorship, broadcasting and supply of services to the English Football Leagues including the Premiership, Championship and Leagues one and two (Connell, 2018). Consequently, English football clubs represented 10 of the top 20 highest revenue earners in world football for the season 2016/17 (Deloitte, 2018). Central to these achievements is a requirement for sustained on-field team performances and entertainment for fans (Relvas et al., 2010, p166). To support these aims, widespread contemporary investment in PHCTs within English football (Wagstaff et al., 2015) may signify a belief amongst club stakeholders that performance outcomes are increasingly dependent upon these *multi-disciplinary* support teams. It is therefore not surprising that the demands for consistent success have never been greater for both the players and those charged with their management (Gilmore and Sillince, 2014). However, despite such a rationale, there is little evidence in the literature to illustrate how effectively structured these teams are and how well their processes impact outcomes of their work.

The working environment in which PHCTs operate is a particularly challenging one, where there is a need to balance a commitment to protecting the health and the wellbeing of players alongside extremely demanding competition. The duty of care implicit in PHCT's work is embodied in UK law (Health and Safety at Work Act 1974) and is supported by the laws, directives and educational materials provided by the international governing body of football (FIFA) (Ekstrand, Dvorak and D'Hooghe, 2013). In a hospital environment, multi-disciplinary healthcare teams including doctors and consultants have a clear duty of care for patients that is fundamental to their training (Beuermann, 2018). In football, although this duty of care is similarly spread across a wide array of *multi-disciplinary* staff, the pressures to win and the risks associated with some aspects of decision making (e.g., returning players from injury to competition) provide a unique challenge. There is also evidence that the pursuit of improvements that contribute to winning have a growing presence in practitioners' work, where performance has become a dominant theme across a range of disciplines including sports medicine and science (Chamberlain, 2008).

This is exemplified by the work of Gilmore and colleagues (2018) that illuminated the working life of support staff in the English Premier league. This rare account focused on sport psychology practitioners and reported that the main pressures in professional football are driven by the need to win the very next game, and that, any longer-term planning has difficulty in attracting other support team members', due largely to their own commitment to these short-term demands.

The pursuit of winning at all costs can also have an impact on staff performance and the outcomes of their work. This is further exemplified by a study by Arnold and colleagues (2017) that explored organisational stressors encountered by support staff across an array of elite sports including professional football. They described four main themes that illustrated the stresses encountered by what was termed 'the team behind the team,' categorised as 'relationship and interpersonal', 'physical resource', 'contractual and performance development', and 'organisational structure and logistical issues'. The result of these organisational stressors was reported to include negative emotional (anger, frustration) and outcome (job performance, wellbeing and mental health) consequences. Such self-reported factors reveal that the workplace context and conditions in which support teams operate are extremely challenging and, at times, negatively impact practitioner working performance. Similar conditions reported in research across a range of elite sport working environments concur with a view that it can become difficult for practitioners to function effectively as a team (Eubank et al., 2014).

Practitioners and coaching staff are measured in the football industry by competition results that have significant implications for the economic and financial aspects in each club (Panagiotis and Konstantinos, 2018). When success (or perceptions of it) is not delivered, dismissal of even the most experienced practitioners is common, particularly following a change in the head coach or manager (Gilmore and Sillince, 2014). During the 2016-17 season, seven Premiership and fifteen Championship league managers were dismissed having had average tenures of 1.31 and 0.95 years in those leagues, respectively (League Managers Association (LMA), 2017). Hence, professional football environments are increasingly volatile, unpredictable occupational domains, characterized by regular organizational insecurity that impacts not just coaching but also the array of *multi-disciplinary* practitioners who have little job security when in post (Malcolm and Scott, 2011; Potrac et al., 2012). This may have potential ramifications for the way in which PHCTs practice, their team culture (the essence of an organisations aims and working practices) and the resultant outcomes of their work, due to the ever-changing environmental working conditions in which they work (Eubank et al., 2014). To date limited reference to these considerations and their impact on performance and health outcomes have been documented in the literature.

2.12 The English Elite Football Leagues

The English domestic professional football leagues have seasons that extend over 10 months of a calendar year. The Premier league and Championship

represent the top two leagues, between which teams can be relegated and promoted depending upon their performance during any particular season. These leagues can require participants to compete in 60+ matches per season, with a selected few participating in additional international competitions (Carling et al., 2015b). For example, preceding 2002 World Cup tournament, the range of matches played by domestic clubs of countries entering the tournament was between 40 and 76 (Ekstrand et al., 2004a). English teams had played between 65 and 76 matches whereas French teams had played fewer than 50. Unlike many other European countries, English teams also compete without a winter break, resulting in limited periods of respite from the demands of competition. League matches alone require Championship football players to compete on 46 occasions compared with 38 in the Premiership league where, playing two or more matches per week is a common occurrence (Lago-Peñas et al., 2009). As a consequence, the length of each season and the competitive nature of domestic English football make the PH demands on players substantial, such that some players may not fully recover between seasons (Reinke et al., 2009). For example, a football match can demand average and peak heart rates between 85-98% of maximal values, requiring 75% of maximal oxygen uptake (V_{O2max}) over the course of 90 minutes competition (Mohr et al., 2005). This places significant stresses on physiological systems, including the muscular, endocrine and immune systems (Thorpe and Sunderland, 2012) that must be managed in association with the psychological demands of elite football competition (Ivarsson, 2010). It has been well documented that during periods of match congestion, when recovery periods are short, physiological and psychological recovery may be sub-optimal (Laux et al., 2015). This may leave players vulnerable to infection and compromised health due to immunosuppression (Reinke et al., 2009; Malm et al., 2004), as well as at an increased risk of injuries (Bengtsson, Ekstrand and Hägglund, 2013). Elite football is therefore extremely demanding for both the players that must train and compete as well as those charged with their performance and health management, particularly in the English Championship league.

2.13 Health Implications for Team Performance

When elite European football clubs experience reduced availability of squad members through injury, not only is there the potential for team performance to be negatively affected but there is also a substantial economic cost that in some cases may exceed €17000- €20000 per day or €20 million per season (Ekstrand, 2013a). Injuries and illnesses often involve medical fees and increased insurance premiums (Woods et al., 2002) Football clubs, as businesses, seek the best returns on their investment in players through appearances in matches, high level performances and perceived success across competitions. This creates a tension between performance and player health.

Football squads with fewer injuries and more consistent uninterrupted training have been shown to perform better and finish in higher final league positions at amateur (Ekstrand, 1983) and professional levels (Eiral et al., 2013). This latter

study of teams within the Qatar professional league found that lower injury rates were highly correlated to final league position ($r=0.93$, $p=0.003$). Although this study was conducted in a small league (10 teams) and for which geographical differences cannot be excluded (Qatar league allows replacement of long term injured i.e. >six weeks, with newly purchased players, which could bias the results and overestimate this relationship), the link between the PH of squads and team success has also been recognised in national and international tournaments that include European teams (Hagglund et al., 2013). Hagglund and colleagues followed 42 teams from nine European countries for 11 seasons and reported an injury incidence 7.7 injuries/1000 h, injury burden 130 injury days lost/1000 h and player match availability 86%. With each team's injury rate and performance evaluated using its own preceding season data, lower injury burden ($p=0.011$) and higher match availability ($p=0.031$) were associated with higher final league ranking. Similarly, lower injury incidence ($p=0.035$), lower injury burden ($p<0.001$) and higher match availability ($p<0.001$) were associated with increased points per league match (Hagglund et al., 2013). This evidence suggests that the success of each football club through team performance is inextricably linked to the health of its players.

A recent systematic review focussed on the impact of injuries on successful performance across a range of sports including football (Drew et al., 2017), concluding that injuries to squad players before and during competition reduced the chances of success. However, despite considerable evidence to support the view that injuries negatively impact performance in football and a range of team sports (Drew et al., 2017), the mechanisms by which this occurs are less well established. Since PHCT's have an important role to play in performance health management, they can be considered central to the aspirations of football clubs when their combined expertise as a team would seem the most appropriate means by which to effectively impact the health of their football squads. Yet, how effectively they are able to do this has surprisingly, not been reported in the literature. This is despite teamwork effectiveness research outside of sport, keeping up with a significant demand for scientifically rooted guidance in a range of industries and organisations (Salas et al., 2008). Sports science and medicine research has contributed to individual sporting effectiveness; however, it would seem that elite football in this instance has not benefited from the science of teamwork effectiveness.

2.14 Teamwork Effectiveness Research

Teamwork effectiveness has been a central question of empirical enquiry for decades in the healthcare industries (Fried et al., 1988; Sims et al., 2015) crisis resource management (Cooper et al., 2002; Gaba et al., 2001; Holzman et al., 1995) and organisational studies (Cohen and Bailey 1997). These studies support the use of *multi-disciplinary* teams to address the demands and performance pressures that various organisations face (Kozlowski and Ilgen, 2006). Similarly, employing teams has been the strategy of choice for organisations confronted with complex challenges, especially when the task exceeds the capacity of an individual and are performed under stressful conditions (Salas et al., 2008). Teams have thus been conceptualised as

information processing units with the capability to develop what has been termed team-level macro-cognition (Hinsz et al., 1997) or to solve problems using processes that encode, store, retrieve and analyse data using various team processes (Salas and Fiore, 2004). Healthcare is a prime example, where there has been an increasing reliance on *multi-disciplinary* teams (e.g. consultants, physicians, nursing, social workers and physical therapists) to organise service delivery across primary, critical acute and long-term care (Tempkin-Greener et al., 2004). However, in this industry, teamwork failures within team processes, including communication have been found to account for up to 70-80 percent of serious medical errors (Classen et al., 2011) and are the third most common cause of death in the United States (Mayo and Woolley, 2016).

Communication is a well-documented fundamental cause of medical errors, industrial disasters and air crashes associated with teamwork failures across these high-pressure industries (Kozlowski and Ilgen, 2008). This has fostered significant research efforts focussed on understanding teamwork effectiveness (Salas et al., 2008) and preventing patient/service user harm ((Classen et al., 2011) and improving productivity across a range of organisations (Kozlowski and Ilgen, 2006). The science of teamwork performance has consequently produced a wealth of knowledge on how to form and manage (Salas et al., 2008), structure and measure (Kozlowski and Ilgen, 2006; Mathieu et al., 2008) and coach (Mesmer-Magnus and DeChurch, 2009; Peters and Carr, 2013) to improve teamwork effectiveness. One of the key lessons learned from this research relates to team member interaction, where the terminology used to describe teams is of paramount importance.

Teamwork effectiveness studies use the terms “multidisciplinary” or “interdisciplinary” to describe teams and most importantly the methods they employ. This has become a useful way to differentiate between teams because of the different processes they imply. Unfortunately, the use of these terms has been very inconsistent in the literature, making comparisons extremely difficult across studies (Molyneux, 2001). When used as a way of describing how teams interact (their teamwork approach), “interdisciplinary” teams can be defined as groups of professionals from different disciplines who work together, sharing responsibility for collaborative decision-making and outcomes (McCallin and Bamford, 2007). Conversely, “multidisciplinary” teams, are described as those where individual members work towards their own goals within a team structure (Roelofsen et al., 2001). The subtle use of the prefixes ‘multi-’ and ‘inter-’ to reflect the differing intensities of integration between professionals, provides a valid way of defining teams and the underpinnings of their teamwork processes (Korner, 2009). This remains essential for understanding differing teamwork practices and placing into context the outcomes of work in a variety of settings. Common to most of these research endeavours, is an acceptance that teamwork is essentially focussed on behavioural processes (Sutton et al., 2011) and non-technical skills (communication, collaboration and situation awareness) (Ilgen et al., 2005, Flin et al., 2010) as well as the cognitive and emotive states that emerge from the interaction between team members (e.g. cohesion and conflict). The conceptualisation of teamwork effectiveness has focussed on teamwork being nested in team performance and processes considered as a

set of interrelated cognitions, attitudes and behaviours (Salas et al., 2008). By investigating relationships between team processes and outcomes of team member work, an improved understanding of teamwork has emerged to serve safety and the quality of service provision in healthcare (Patey et al., 2008) and aviation (Gaba, 2010) as well as productivity in manufacturing industries (Jaca et al., 2013). Posing questions in research regarding the contribution of organizational teams, to organizational effectiveness, is therefore of great practical relevance and theoretical importance and one that can be considered for a variety of teams including those in sport.

Early reviews of teamwork research are consistent with more contemporary investigations that concluded there to be a direct relationship between teamworking and organisational performance outcomes as well as team member attitudes. For example, a review of 12 large scaled surveys and 185 case studies of emerging managerial practices across a range of American mass production industries concluded that, team-based working lead to improvements in organisational performance when measured by efficiency (based on costs) or productivity (Applebaum and Batt, 1994). Similarly, Delarue and colleagues (2008) in their review of survey-based research across industries, concluded that teamwork had a positive impact on; operational, financial, attitudinal and behavioural outcomes. More recently West and Lyubovnikova, (2013) concluded from review of healthcare research that both staff and patient outcomes were related to fundamental teamwork factors including which leadership, reflexivity and team objectives. These reviews suggest that teamworking serves a range of important functions but, they did not provide quantifiable estimates of the teamworking-effectiveness relationship.

The healthcare industry has received significant attention in research focussed on teamwork, in part due to its importance to population health and its relationship with political and policy agendas (Borras et al., 2014). A very specific set of challenges confronts teamwork in healthcare, including the demands for high quality care, an ageing population (particularly in western societies), the need for a wide variety of specialist disciplines to work together and the stressful nature of certain aspects of work (West and Borrill, 2005; Borrill et al., 2000). Research evidence spanning nearly three decades suggests that effective teamwork in healthcare is associated with increased patient safety, reduced medical errors and improved job satisfaction amongst employees (Erestam et al., 2017; Hughes et al., 1992; Liff, 2011; Manser, 2009). Collectively, the powerful message that emerges from these works is that teamwork effectiveness saves lives. Not restricted to self-report measures or softer outcomes (e.g. employee satisfaction), these and other studies have demonstrated a relationship between teamworking and objective outcomes. A well cited example includes the works of West and colleagues (2002), who investigated 61 hospitals in the UK to determine the impact of teamworking through management practices on mortality. The results illustrated that the number of staff working in teams had a strong negative relationship with patient mortality (standardised regression: $\beta = -0.364$ $p < 0.01$). In this instance, those hospitals where 60% of staff reportedly worked in formal teams had the lowest mortality.

Elite sport has followed in the footsteps of these human service industries, with the rapid growth in the number of support teams servicing athletes. It is now common for athletes across a range of sports, including football, to be increasingly dependent upon sophisticated systems of innovative medical/scientific management by *multi-disciplinary* support teams (Waddington & Smith, 2009). To illustrate, Carling and Court (2012) described the permanent quest for success in football as driving the 'systematic collection, analysis and interpretation of information collected on football athlete's performance by an array of practitioners focussed on guiding decision-making that generates feedback for training prescriptions and match preparation' (Carling and Court, 2012; page 173). However, it may be that multi-disciplinary support teams in football are an incidental by-product of a need to access a wide range of professional services. Should this be the case, PHCTs may function sub-optimally, if they fail to consider the teamwork factors that have been demonstrated to shape outcomes of teamwork in organisations outside of sport. It would also indicate that, unlike healthcare personnel who are now subject to teamwork effectiveness training (Miledler et al., 2014) and are supported by the findings from a large volume of research (Barrick et al., 1998; Cohen and Bailey, 1997; Holzman et al., 1995; Jaca et al., 2013), PHCTs have limited frames of specific reference from evidence-based literature to support their activities as *multi-disciplinary* teams. This is despite the significant requirement for collaboration and integration of practitioner knowledge to meet the substantial health and wellbeing challenges faced by football players (Ekstrand et al., 2017).

2.15 The Health of Professional Football Players

Paradoxically, football as a recreational activity can be both beneficial and detrimental to health according to a systematic review of over 80 research papers published since 2009 (Oja et al, 2015). This research highlights the benefits of recreational football training, or what has come to be termed 'Soccer Fitness'. For the general population, football can make a significant contribution to overall health/wellbeing and the prevention and treatment of non-communicable disease across the lifespan (Bangsbo et al., 2014). However, when football becomes a professional occupation, the risk of injury is particularly high and participation can negatively impact players' careers and post career health (Carling, 2010; Bjerneboe, 2014). Practitioners charged with managing the performance and/or health of professional players need to be mindful of these considerations and there has been a considerable volume of research which highlights this challenge.

The seminal works on injury risk in professional football were conducted in the late 1990s and early 2000s. Researchers were able to assess the risk of injury in professional football at that time with clear reference to the UK's Health and Safety legislation (Fuller and Hawkins, 1997). This was an important landmark in research that identified occupational health parameters in a sport, considered the health of employees in the workplace and drew attention to the role that legislation plays in defining responsibilities of employers in assessing risks (Drawer and Fuller, 2002; Drawer, 2000). Using an injury classification defined under the Reporting of Injuries, Diseases and Dangerous Occurrences

Regulations (HMSO, 1995), this highlighted that employees in the UK incur, on average, 0.4 reportable injuries per/100,000 working hours with a range between 0.3 for the finance sector and 1.3 for mining and other high-risk industrial occupations (Drawer, 2000). In football, injury was defined as an injury received during competition or training that prevented the player from participating in competition or normal training for at least one day, not including the day of the injury and recorded by a physiotherapist within each club (Drawer and Fuller, 2002). It was determined that 710 injuries per/100,000 hours of match-play and training occurred, making this occupation significantly higher risk than industrial occupations outside of sport (Drawer and Fuller 2002). These early researchers were some of the first to identify important roles for sports medicine and science practitioners in the management of footballers' health through prevention and rehabilitation (Drawer and Fuller, 2002). These roles have grown immensely since the time of these publications to incorporate a wider variety of practitioners involved in what has been termed "squad management of player availability" (Carling et al., 2015a).

In a series of studies, it was also determined that acute and chronic injuries had an impact on the longer-term health of retired players, where nearly half (47%; sample 185 respondents registered with the Professional Footballers Association) reported being forced to retire because of injury (Drawer, 2001). Despite the increasing presence of PHCTs during more modern times, these compromised post-career health trends seem to have continued. For example, prevalence rates of knee osteoarthritis in retired players have been reported to range from 40-80%, which is considerably higher than that found in the general population (Fernandes et al., 2017). Similarly, a systematic review of sixteen studies that included 1576 former players found the early onset of both hip and knee osteoarthritis was prevalent (Lohkamp et al., 2017). The indication from these early and more contemporary studies was that professional players can develop health issues during their careers that extend into retirement. In the context of modern football, these works also bring into focus a need for further research that illustrates the contribution of PHCTs to the short and longer-term health of professional football players.

Surveillance studies of injuries in football are recognised as an important starting point to understanding these health challenges. The Fédération Internationale de Football Association (FIFA) and the Union of European Football Associations (UEFA) both have responsibility for governance of professional football including the health and wellbeing of professional players. These governing bodies have supported surveillance study research to guide their own laws and directives that shape some of the risk factors associated with participation in this sport and the practices adopted by PHCTs. Most of these surveillance studies use a time loss definition recommended by the International Soccer Injury Consensus Group (Clarsen et al., 2013). In this instance, injuries are classified as those that prevent an athlete from fully participating in training or matches, independent of whether the player was selected in the next match. For research purposes this draws a clear line (Harøy et al., 2017); however, in reality, the PHCTs manage players who train

and compete through injuries, depending upon their severity and the importance of matches (Carling et al., 2015a). Practically, this highlights the significance of PA to the day-to-day objectives of PHCTs and that players participating in competition are not always in optimum health and physical condition (Charlton et al., 2017).

Inherently linked to PA are the injury incidence and burden rates reported in professional football. The impact of injury in the highest achieving European football clubs is illustrated by the ongoing UEFA Elite Club study (UEFA, 2017). For the 2016/17 season, the injury incidence and burden rate were recorded at 2.3 and 37.0 per 1000 hours training exposure, respectively. A higher injury incidence has typically been recorded in matches, reported as injury incidence and burden rates of 19.8 and 456 per 1000 hours exposure. During this study the incidence of injury for these elite teams equates to 8.0/1000 hours exposure or, put differently, a squad of 25 players can expect 50 injuries per season that leaves players unavailable for match selection and/or training. Although these values may not be representative of the larger group of clubs that do not make Champions league qualification, it does represent the largest injury surveillance initiative in the world and covers teams across the whole of Europe. This type of surveillance study and others reported over the last decade or so, at both club (Hägglund et al., 2005) and national team levels (Ekstrand et al., 2004b) inform current PHCT practices (Drust and Green, 2013).

Research conducted in a broader range of European clubs indicates that the injury incidence ranges between 15.9-27.7 injuries/1000 match hours, and 1.9-5.3 injuries/1000 training hours (Andersen et al., 2004; Bjerneboe et al., 2014; Hawkins and Fuller 1999; Hägglund et al., 2006; Ekstrand et al., 2011; Pfirmann, 2016). For instance, in a most recent systematic review, Pfirmann (2016) reported injury incidence (in training and competition) to range between 2.48-9.4 injuries per 1000 hours exposure where injury rates in competition were also higher than those recorded during training (8.7-65.9 vs 1.3-5.8 per 1000 hours, respectively) consistent with the vast majority of research.

The works of Bjerneboe and colleagues prospectively studied Norwegian elite teams over six consecutive seasons and during this study there was an annual increase of 1.06 acute match injuries/1000 h (95% CI: 0.40–1.73), corresponding to a total increase of 49% during the six-year study period (Bjerneboe et al., 2014). During this study there was an annual increase of 1.06 acute match injuries/1000 h (95% CI: 0.40–1.73), corresponding to a total increase of 49% during the six-year study period (Bjerneboe et al., 2014). These rising trends in injury are a concern because they reflect trends seen across other European clubs (Ekstrand et al., 2016) and despite an increasing presence of PHCTs in European football (Drust and Green, 2013).

In International and European tournaments, the injury rates in training are similar to club football (2.1-4.6/1000 training hour), while the match injury rates are usually higher, ranging from 33.1-45.8/1000 match hours (Hägglund et al., 2009; Junge and Dvorak, 2013; Waldén et al., 2007). Given that PHCTs in club football have responsibilities for players returning from International

tournaments, these results indicate they are faced with an added burden when players return injured. How they manage this has not been reported in the literature, but it would suggest that processes which foster collaboration between PHCTs in domestic clubs and those with national teams would be beneficial for both parties.

Despite a significant research focus on the epidemiology, risk factors, incidence and prevention of football injuries (Ekstrand, et al., 2011a) there have been relatively few studies of illness in football. Both illness and injuries contribute to the availability of players for competition, but injuries in professional football present a much greater challenge to player health in the highest levels of European domestic league and tournament football (Dvorak et al., 2011; Moseby Berge and Clarsen, 2016). For instance, in an epidemiological study by Bjerneboe and colleagues (2016) 1.5 illnesses per /1000 player days was demonstrated. These works were conducted with premier league clubs in Sweden, who were followed prospectively for four consecutive seasons recorded an illness episode when a player was unable to participate fully in training or competition. Results indicate that a player experienced an illness episode once every second season, which represented a median of three days absence from training and competition (Bjerneboe et al., 2016). Similar results have also been found in other European club studies (Orhant, Carling and Cox, 2010) and in International football tournaments (Theron et al., 2013), indicating that illness represents a significantly smaller impact on PA and PHCT resources.

Several injury risk factors have been identified that can inform the PHCT's daily decision-making (Drew et al., 2017b) and provide PHCTs with a basis for the development of injury prevention programs (O'Brien, 2017). For example, previous injury is considered a significant risk factor for subsequent injury in football (McCall et al 2016), as are training load and match congestion (Ekstrand, 2017; Gabbett 2016; Soligard et al., 2016). In a study of Swedish first league players, injury in the first season studied was identified as being a significant risk factor for injury in the next season (hazard ratio 2.7; 95% CI 1.7-4.3, $p < 0.0001$) (Hagglund et al., 2006). These authors proposed that the association between previous injury and increased injury risk will be partly accounted for by recurrent injuries, but some will be anatomically unrelated. It is possible that following rehabilitation there are still deficits in conditioning or proprioception, or that altered movement patterns result following a previous injury, providing a plausible link to unrelated injury in the following season (Hagglund et al., 2006). Similarly, acute hamstring tears represent 12-16% of injuries in football (Ekstrand et al., 2011) and can have a recurrence rate of between 12-31% (Woods et al., 2004). For PHCTs to effectively manage these risks, it is their collective expertise or aggregation of knowledge that may be important because informed decision-making will rely on a range of skills; however, the implications of such interactions for injury prevention remain unclear.

There are many well-evidenced injury prevention programmes that have been demonstrated to be effective in professional football (Arnason et al., 2004; Schuermans et al., 2016). For example, implementation of neuromuscular training has consistently been shown to reduce the risks of hamstring tears as well as increase the effectiveness of rehabilitation should an injury occur (Mendiguchia, 2015). Arnason and colleagues conducted a study of elite Icelandic teams over 4 seasons, using eccentric strength (Nordic Hamstring) to determine its impact on the incidence of hamstring strains. With the first two seasons used as a baseline, the third season involved 48% of the teams selected to use the intervention program. The incidence of hamstring strains was lower in teams that used the eccentric training program compared with teams that did not (RR=0.43, P=0.01), as well as compared with baseline data (RR=0.42, P=0.009) (Arnason et al., 2008). These studies indicate that appropriately conducted interventions by PHCTs can have a significant impact on the reduction of injury risk, and specifically muscle injuries, which are a particular problem in professional football and ultimately impact PA for competition. However, there are likely other factors contributing to rising injury trends in European professional football particularly when recovery periods between matches are short.

2.16 Match Frequency and Performance Health

The number of competitive matches that comprise a professional football season, considering both domestic and international competition, has markedly increased in the last decade (Lundberg and Weckstrom, 2017) such that player can play between 50-70 matches per season (Carling et al., 2015). Consequently, effective recovery processes, injury prevention and match load monitoring have become important in the optimisation of performance and health (Ispirlidis et al., 2008). It is well documented that neuromuscular fatigue, glycogen depletion, muscle soreness/damage and reduced anaerobic performance occur in response to a competitive football match (Mohr et al., 2003). It has also been shown that neuromuscular fatigue and a player's perception of recovery, may require more than three days before being restored to pre-competition levels (Nedelec et al., 2014; Ispirlidis et al., 2008). However, fixture schedules often require football players to compete in another match after only two resting days, which represents "match congestion" (Dellal et al., 2015). The magnitude of post-match fatigue is related to both extrinsic (match result, quality of opponent, match location and playing surface) and intrinsic (training status, age and experience) factors that will potentially influence the time course of recovery for each player (Ranchordas et al., 2017). It is therefore clear that when competitive matches are sequenced closely together, there can be negative implications for performance through fatigue, and this can increase injury risk when recovery is incomplete (Dupont et al., 2010).

Investigations of both performance and health as they relate to match congestion in football have produced mixed results. For instance, in a study comparing teams competing in either one or two matches per week, no significant differences were found in motion characteristics during the matches,

but higher injury rates were associated with higher match frequency (Dellal et al., 2015). In this study, motion characteristics and technical performance (e.g. distances covered, pass completion and duels won) were assessed using a computerised camera/tracking device which suggested that 72-96 hours of recovery was sufficient for physical and technical performance to be maintained. However, the injury rate during matches was higher [43.3 (CI, 95%, 33.3–57.5) vs 18.6 (CI, 95%, 16.3–21.3) per 1000 hours] during the congested periods compared to non-congested periods. The authors suggested that this could be ameliorated with better recovery processes and player rotation, although this was not investigated in the study nor were the contextual factors that influence match demands (Carling et al., 2010).

Dupont and colleagues (2010) highlighted the importance of support staff when studying match congestion, performance (motion characteristics) and injury rates in Scottish and Champions League football. In this two-year cohort study, injury incidence and performance were assessed when individual players had played either one match in six or more days or two matches in four days (i.e. one match per week vs two matches per week). In this instance, the combined match and training injury rate was significantly higher when players played two matches per week (25.6 /1000 hours; 95% CI: 20.8, 30.5 vs 4.1 /1000 hours; 95% CI: 3.0, 5.1). However, match performance based on motion characteristics (i.e. distance covered and high intensity running and number of sprints) showed no change between the different match cycles and were similar to those found in other studies (Rampinini et al., 2007). The authors suggest that motion characteristics were maintained because the players in this study were advised to follow a strict, evidence-based post-match recovery strategy, guided by the support team. This involved the use of compression garments for 12 hours post-match, contrast bathing and carbohydrate meals. During congested fixture schedules, these recovery strategies have been deemed essential to alleviate post-match fatigue, enhance recovery for subsequent performance and reduce the risk of injury (Nédélec et al., 2013a). However, in this instance the post-match recovery programs were unable to ameliorate the impact of the 2-match a week cycle on injury incidence, which may be related to the adherence of the players to these programs (not reported in this study) that can be problematic in football (Ekstrand et al., 2013).

Studies that have considered short (Dupont, 2010; Lago-Penas et al., 2011; Carling et al., 2016; Lundberg and Weckstrom, 2017; Page et al., 2017) and prolonged (Carling and Dupont, 2012; Djaoui et al., 2015; Soroka and Lago-Penas, 2016) periods of match congestion have typically measured either performance (motion characteristics, match outcomes and perceived performance) or health (injury incidence, injury type and physiological measures). In two studies that investigated both performance and health during shorter periods (≤ 3 days) of match congestion that typify those seen within the English football calendar similar findings in injury risk were reported (Bengtsson et al., 2013; Carling et al., 2010). Bengtsson and colleagues (2013) followed 27 European elite teams prospectively over 11 seasons across domestic league and European cup competitions. Associations between the recovery time

between consecutive matches (≤ 4 days vs ≥ 6 days) and injury rates suggested that ≤ 4 days recovery led to elevated total [Rate Ratio (RR) 1.09, 95% CI, 1.00 to 1.18] and muscle (1.32 95% CI, 1.15 to 1.51) injury rates. Soft tissue injuries (hamstring and quadriceps) were most common, with the incidence of hamstring match injuries estimated at 5.74 vs 4.47 per/1000 hrs exposure (RR:1.28, 95% CI, 1.06 to 1.56, $P=0.011$) for ≤ 4 days compared with ≥ 6 days' recovery, respectively. Bengtsson and colleagues also found that for teams playing in domestic leagues across Europe, match performances did not deteriorate; however, more Europa league matches (a higher-level tournament) were lost (39%, $p= 0.048$) when shorter (≤ 3 days) recovery periods were observed. Team performance in this study was based on the percentage of matches won in each five-consecutive match sequence. The results suggest that as the level of competition increases, a team's ability to recover from the previous match is a determinant of subsequent success, which in turn may be related to the work of the PHCT which was not measured in this study.

When both injuries and performance were considered in French 'Ligue 1' games over longer periods of match congestion (8 successive matches in 26 days) and compared with less frequent match schedules outside of these periods, the incidence of injury was similar 50.3 vs. 49.8 per 1000 h exposure (t-test; $p=0.94$) (Carling et al., 2012). Similar conclusions were drawn from studies with French national team players monitored through their participation in six matches separated by three days and compared to non-congested periods of 1 match per week (Dellal, et al., 2015). Total incidence of injury (matches and training) across congested periods did not differ from the non-congested cycles. However, the rates of injury during match-play were significantly higher for congested 43.3 per 1000 hours exposure (CI 95%, 33.3-57.5) versus non-congested periods 18.6 (CI 95%, 16.3-21.3) per 1000 hours exposure ($p<0.001$). In addition, the number of injuries in training during non-congested periods was much higher than that during congested periods [4.6 (CI 95%, 3.2–5.8) vs 14.6 (12.2–17.1 per 1000 hours exposure)] (Dellal, et al., 2015).

These two studies indicate why so much investment has been made into PHCTs and their perceived importance in professional football, particularly during match congested periods. For example, in the former study, Carling and colleagues (2012) also reported the use of post-match recovery procedures including immediate contrast therapy (hot and cold immersion), compression garments, hydrotherapy, soft tissue massage, nutritional practices using low/high glycaemic index carbohydrates/proteins and hydration drinks that have been reported in the literature as having some efficacy (Nédélec et al., 2013b). These interventions by support staff have substantive research evidence to support their efficacy, marking one of few studies to cite both immediate post-match and between match strategies used by PHCTs. However, using such an array of practices will require the PHCT to have structures and processes that are able to deliver during very hectic and demanding periods of competition (Arnold et al., 2017).

The works of Dellal and colleagues (2015) also draws attention to the work performed by PHCTs. This study reported the incidence of injuries to be higher during training than in matches, which runs contrary to the findings in most other research (Pfirrmann, 2016), indicating that training load errors may be responsible (Gabbett et al., 2016). Football injuries are sustained while players are exposed to training and/or competition workloads. Match loads are largely dictated by the competitive demands of the sport, while training loads are applied to the athlete in order to induce physiological, technical and psychological gains (Windt and Gabbett, 2017). This gives PHCTs a significant degree of 'workload control' during training activities that is not enjoyed during competition (Carling et al., 2015). Therefore, PHCTs have a significant co-ordinating and implementation role to play which requires both technical (e.g. load management) and non-technical skills (e.g. communication and collaboration) in a sporting environment (Gabbett et al., 2016; Carling et al., 2015a).

Continuous workload and fatigue monitoring during match congestion represents the most effective evidenced-based method available for managing the health and supporting the performance of professional players (Schwellnus et al., 2016). Athlete monitoring serves to identify the optimal workload that improves fitness, reduces the likelihood of injury, identifies fatigue and improves potential performance (Gabbett, 2016). During each in-season weekly cycle, the PHCT, in conjunction with the coaching staff, aim to provide all players with an appropriate training stimulus and sufficient recovery when accounting for match exposure. However, the training process can result in different outcomes: performance and health gains (e.g. improved strength) or performance and health losses (e.g. injury and illness) (Kenttä and Hassmén, 1998). For instance, excessive loads and insufficient recovery leads to maladaptation to the training stimulus and increase the risk of injury and illness (Gabbett et al., 2016). The relationships between workload monitoring, recovery, injury/illness and performance all form part of an emerging field of research. Available evidence suggests that there is a dose-response relationship between both training/competition workload that an athlete can undertake and the incidence of injury/illness (Drew and Finch., 2016). This was also the conclusion of the International Olympic Committee (IOC) consensus review of evidence concerning load and health in sport (Soligard et al., 2016). Hence, football players exposed to sudden increases in the training or match loads ("spikes"; i.e. sudden increases in load e.g., during match congestion or following return from injury to competition), and even those exposed to a training load deficiency, may be susceptible to soft tissue injury when not sufficiently prepared (Gabbett 2015). This is particularly important for PHCTs, not only because they need insights into the load that is safe and appropriate to prescribe across football squads but also because incorrect load prescription for one day can have negative consequences for injury risk for up to four weeks (Orchard et al., 2009). This may will leave very little room for error during match congestion when PA is particularly important and when a variety of practitioners interact with the players.

The PHCT faces the added challenge that each player's exposure and response to competition, training, recovery and psychological challenges will vary based on their individual intrinsic characteristics (e.g. age, fitness, previous injury, training history) (Gabbett et al., 2014). This makes squad management during competition particularly challenging given the potential for large intra- and inter-individual variations in response (Soligard et al., 2016). Consequently, there is no one-size-fits-all approach to effectively manage football squads, as demonstrated by the widely varying choices in techniques used to perform these tasks (Arkenhead and Nassis, 2016). The work of Arkenhead and Nassis (2016) suggests that in many instances the choices made by PHCTs are reflective of the resources available and organisational structures within clubs. For example, individualising each athlete's training load amounts to a huge task for PHCTs associated with large squads, generating significant amounts of data during match congested periods (Buchheit, 2017). Data management has been recognised as a significant stressor for support staff across an array of elite sports, including those involved in professional football where both the management and turn-around times (collection-analysis-feedback) are significant contributors to stress (Arnold et al., 2017). Practitioners reportedly consider this data management stress to have a negative impact on their own performance (Arnold et al., 2017). Should this occur during match congestion, it could have ramifications for the PH of the players, providing a link between the practice and outcomes of PHCT work.

Successful teams will inevitably play the most matches but they are also most likely to have larger squads and a greater contingent of players who represent their national teams (Scoppa, 2015). PHCTs must also manage the health of players in transition between national team and club competition, who have an individual match schedule that is generally not considered in the literature. However, research has demonstrated that football players that represent their countries can have a higher risk of injuries when competing in international summer tournaments at the end of their domestic seasons (Ekstrand et al., 2004a). In a study of 11 elite European clubs, 60% of the players who had played >1 match per week for the last 10 weeks of the football season incurred injuries or underperformed (as assessed by three former international coaches) in the World Cup tournament in 2002 (Ekstrand et al., 2013c). Fatigue may have played a role in these injuries, as these national team players competed more matches per week in the last 10 weeks of the season than they did during the first 36 weeks (1.12 Vs 0.97, $p < 0.01$ respectively). This suggests that every second year when the domestic seasons are followed by international tournaments and there is little time for rest and recuperation, national team players are at increased risk of injury. This also highlights the challenge and important role that support staff must play in the management of workload in transition from club to international football (Ekstrand, 2013c), which may require extended collaboration between practitioners working in clubs and those working with national representative teams.

Match congestion studies have typically suffered from a common limitation in that they fail to account for 'player rotation'. This means that the true risk of

injury in the same players during congested periods may not have been established because team level measurements rather than individual levels of exposure have been used. The ability of the PHCT to identify a need for rotation of players, such that those with at risk of injury/ill health or suboptimal performance can be rested or have reduced loadings, is especially essential during congested periods. In one of few studies to consider player rotation, injuries sustained in match play over a six-season period with a cohort of first team French Ligue One players (n=25) were captured (Carling et al., 2016c). The impact of fixture congestion (2 matches played in ≤ 3 days) was compared to 3 successive matches played with a time interval of ≤ 4 days. There was a significantly greater risk (incident risk ratio (IRR) in the final match in the three-match congestion cycle; (47.0 (95% CI 31 to 63) vs 93.6 (95% CI 43 to 144), IRR: 2.0 (95% CI 1.1 to 3.8), $p=0.0345$) and a non-significant but greater risk of injury in the final 15 minutes of play in the second match separated by 72 hours. This study is important in that it more truly reflects the potential impact of match congestion on each player, based on their actual exposure, and suggests that three successive matches with an interval of ≤ 4 days can be problematic for players and the work conducted by PHCTs. However, the cohort studied was small and the results may only reflect the contextual circumstances of that team.

Playing two matches or more per week is typical of the fixture schedules facing most English professional teams, making fixture congestion a regular occurrence. The intervening periods of recovery between matches are important to allow training and remedial practices to be administered by the PHCTs. A high training-to-competition ratio has been associated with team success and lower injury risk (Ekstrand et al., 1983), presumably in part because PHCTs have a greater ability to control loading in training compared to competition, although training load and how it is applied during match congestion has rarely been considered in the literature. During match congestion, individualised load management has been described as a significant challenge for PHCTs because it can be invasive, time inefficient, expensive, generates large amounts of data and can be difficult to perform routinely and simultaneously with large squads of competing players (Carling et al., 2018). PHCTs therefore need to support a range of techniques to effectively gauge, adjust and apply the right loads for all players (not just those competing regularly) in their squads. This is particularly important during match congestion when the challenge to PH is elevated (Al Attar et al., 2018) and implementing strategies to manage recovery from competition whilst providing sufficient stimulus for continued improvements or maintenance of physical, tactical and technical requirements is required (Doeven et al., 2017). How effectively PHCTs are able to manage entire squads during match congestion, will in part be determined by the way they are structured/process their work and hence their teamwork capabilities, which serve to inform decision-making (Gabbett et al., 2016a). These relationships may be related to PA but have yet to be explored in the football literature, representing a key knowledge gap in a performance driven environment that is constantly seeking marginal gains (Syed, 2016).

Match congestion corresponds with elevated work demands not just for players, but also for practitioners and represents phases in a football season when all staff need to be optimally functioning (Carling et al., 2012). Arnold and colleagues (2017) illustrated that practitioners themselves can be working sub-optimally due to the stressors inherent in elite sport. They found that support team practitioners (including those working in the English Premiership football) had emotional responses to pressured phases of their work, including anger, frustration and anxiety, which negatively impacted their performance (Arnold et al., 2017). This highlights the possibility that PHCT squad management could be less optimal in their working capacity during periods of match congestion, with potentially negative ramifications PA.

2.17 PHCT Squad Management and Prioritised Practices

Working in association with coaching staff, PHCTs in football have a fundamental duty to apply interventions catering to very distinct health (Malcolm and Scott, 2011a), performance (Drust and Green, 2013) and coaching needs (Cushion, Armour and Jones, 2003). However, despite reference to squad management, which is focussed on improving the productivity of players (Carling et al., 2015a), limited reference to PHCTs as *multi-disciplinary* teams fulfilling this function can be found in the literature. Furthermore, associations between their practices and subsequent outcomes of their work have not been directly assessed in football. It could be argued that this linkage has already been established in part by those studies which illustrate injury prevention initiatives that seek to optimise the number of players available for matches (Ekstrand, 2013c; Al Attar, 2016; Gill, 2014), but PHCT process were not directly evaluated in these studies. So, whilst they do provide insight into the important roles played by science and medical staff, more evidence is needed to better understand the effectiveness of PHCT contributions in professional football settings.

An editorial in the British Journal of Sports Medicine has expressly addressed the presence and importance PHCTs, indicating that in professional football there has been an undervaluing and lack of appreciation of the importance of the support team practitioners (Orchard, 2009). The author concluded that the importance of the medical staff in improving PA was undervalued by football team management and that player durability (defined as availability through not being injured) may be under-recognised as a crucial factor in team success. Given the growth of medical and science roles in professional clubs since this time, this would no longer seem to be the case (Drust and Green, 2013). A wide array of studies illustrate the diversity of practitioner involvement in football, including physiotherapists (Hides et al., 2011; Kellis et al., 2016; Haser et al., 2017), nutritionists (Williams and Rollo, 2015; Andrews and Itsiopoulos, 2016; Ranchordas, Bannock and Robinson, 2016), sport scientists (Nyberg et al., 2016; Sannicandro et al., 2017), performance analysts (Memmert, Lemmink and Sampaio, 2017) and soft tissue treatment specialists (Nédélec et al., 2013). This supports the view that squad management requires a diverse array of

support staff to manage important complex PH demands of contemporary professional football.

In one of few studies to link the importance of 'squad management' to both PA and performance, a French Ligue 1 football team was tracked across five seasons. The aim of the study was to identify squad management and performance-related parameters that differentiated a Championship winning season from four others (Carling et al., 2015a). The smallest utilization of players (determined by selection, availability and rotation) occurred during the winning season in 2010/11 where 84% of the playing squad were used, compared to up to 89% in the other seasons. Over the course of the 2010/11 season, 10 players participated in at least 75% of the total minutes of league competition played by the club, compared to only four to six players in the other seasons. Squad utilisation was lowest during the successful season, potentially due to a lower match injury occurrence and fewer working days lost to injury, which maintained the availability of the starting players. The researchers concluded that squad management and PA played a large part in the success during the Championship winning season. Importantly, the support staff introduced a 'systematic injury prevention program' in the winning season, highlighting the potential link between the work of practitioners, injuries, PA and team success. Although cause and effect cannot be established through this study, prophylactic measures have been shown to be effective in the reduction of football injuries (39-57%) when support staff are involved in their implementation (Thorborg et al., 2017; Steffen et al., 2013). Although this study in French elite football was conducted within only one club and results have limited generalizability, the study does indicate the potentially wider importance of squad management to PA and to overall team success.

Surveys conducted by McCall and colleagues provide one of the most extensive but rarely reported insights into the structure and prioritized aspects of practice that PHCTs adopt in contemporary football (McCall et al., 2014; McCall, Dupont and Ekstrand, 2016). The first in this series of studies quantified the injury prevention perceptions and practices of 93 premier league teams internationally (McCall et al., 2014). The second study examined current practices and described coach compliance and player adherence to injury prevention programs at 34 elite European clubs. In this second study, coach compliance was defined as 'commitment to complying with individualised player recommendations' and player adherence as the 'commitment to consistently performing an injury prevention programme' (McCall et al., 2016). Data from the surveys of Premier League teams (McCall et al., 2014) were derived from 27 sport science staff, nine physiotherapists and eight medical doctors, while the survey of European clubs were derived from the 33 teams' head medical officers. Results from these studies (summarised in Table 1) indicate that in elite football in many parts of the world, a tremendous amount of importance is attached to the monitoring of workloads in matches/training, the wellbeing of players and the implementation of injury prevention practices. Player fitness and accumulated fatigue were also prioritised considerations within clubs, which is consistent with the findings from research regarding challenges to professional

player health (Ekstrand, 2016). This is also true of the top five rated exercises used by clubs to prevent injuries, which in this instance correspond with the 'FIFA 11+' injury prevention program (Al Attar, 2016), and the recognition of match congestion as a risk factor for injury (Bengtsson et al., 2013b). Surveys revealed most extrinsic and intrinsic risk factors considered to be important were workload related. The 93 Premier League clubs had an average of 5 ± 2 (range 1-11) staff members who were directly involved in injury prevention programmes, with significantly more physiotherapists than doctors or sport scientists (2.5 ± 1.4 vs 0.8 ± 1.1 vs 1.6 ± 1 , respectively; $p < 0.0001$) in this role (McCall et al., 2014). Historically, the medical staff within each football club have been held responsible for prevention and treatment of injuries, whereas sport science or strength and conditioning staff have been seen as responsible for monitoring training loads and athlete well-being (Ekstrand, 2013a). However, in the Premier League clubs, collaborative practices in the design, testing and application of injury prevention programs between an array of staff roles were reported.

Crucially, lead medical officers rated coach compliance as 'essential' or 'very important' (56% and 41%) to injury prevention programs (McCall et al., 2016). The development of trust and communication, feedback of results, continuous explanation of benefits and education were the favoured strategies to improve compliance. Sixty-one percent of the teams reported 'high' coach compliance with prevention programs and 19% reported 'perfect' compliance (80% combined), providing insight into the working relations between support and coaching staff.

These works shed significant light on the practices and perceived challenges facing PHCTs in football. The suggestion is that the health of players is afforded a significant resource allocation, and match congestion and the management of player workload drive several practices directed at supporting performance whilst mitigating against injury and fatigue. Similarly, these works highlight collaborative practices and the use of combined expertise in the management of performance health, with recognition of a need for good relations with the coaching staff. It should be noted however, that the second study was limited by the exclusivity of responses from the heads of medicine, which may not be representative of the experiences of other practitioners that comprise PHCTs.

Table 1: Prioritized Practices of PHCTs

Author	Teams Involved	Study Type	Areas Of Prioritised Work In Relation to Injury Risk	Most Prioritised Tests/Tools	Prioritised Training/Exercise
McCall et al., 2014	93 Premier League Teams Internationally	Survey of Support Staff (47% Returned)	1. Previous Injury 2. Fatigue 3. Muscle Imbalance 4. Fitness 5. Movement Efficiency	1. Functional Movement Screen 2. Questionnaires 3. Isokinetic Muscle Test 4. Physical Tests 5. Flexibility	1. Core Stability 2. Balance/Proprioception 3. Stretching 4. Eccentric Hamstring 5. Nordic Hamstring 6. Isokinetic
	34 Elite European Teams, UEFA Elite Club Injury Study	Survey of Medical Officers (97% Returned)	1. Physical Fitness 2. Accumulated Fatigue 3. Recovery- Match Congestion 4. Training Load	1. Assessing Workload 2. Subjective Wellbeing 3. General Medical Screen	1. Eccentric Muscle Training 2. Balance/Proprioception 3. Core Training

Contrastingly, in another survey of practitioners in 48 professional clubs in the UK, USA and major leagues across mainland Europe, coach compliance with the work performed by practitioners was deemed a barrier to intervention effectiveness (Akenhead and Nassis, 2016). Support staff in this study were asked to rate their own expected (based on theoretical scientific concepts) and perceived effectiveness (based on experience) of the impact of monitoring and managing player training loads on injury prevention and performance. Differences in expected versus actual effectiveness were 23% and 20% for injury prevention and performance enhancement, respectively (standardised mean difference; $d = 1.0-1.4$; $p < 0.001$). Practitioners attributed the discrepancy between expected and actual effectiveness to their suboptimal integration with coaches, or what was termed ‘coach buy in’. Other factors viewed as contributors to this difference included insufficient human resources and concerns over the reliability of equipment. The work of Arkenhead and Nassis (2016) and also that of McCall and colleagues (2016) suggests that the effectiveness of PHCT’s in their management of PA may in part be shaped by the coaches with whom they work and their ability to gain support, adoption and adherence to selected practices such as workload monitoring.

2.18 Shared Decision-Making During Match Congestion

The PHCT must be able to effectively manage and interpret considerable amounts of data collected from players (e.g. training loads, competition performance, injury rehabilitation progress) (Hallén and Ekstrand, 2014; Scharhag and Meyer, 2014). An integrated teamwork approach has been advocated for managing a variety of shared decisions made by support teams in sport, which are informed by the data they collect (Gabbett et al., 2016). However, in line with terminology more consistent with teamwork research and considering the interdependency required between professionals for complex

decisions, this is best described as an 'interdisciplinary team approach' (Sutton et al., 2011). Whether this type of teamwork approach is adopted within professional football clubs has not been formally investigated, despite having positive results in teamwork research focused on health (Heinemann, 2012). Returning players to training and/or competition (RTC) following injury or illness is an ideal example of where PHCTs can use shared decision-making processes to inform practice (Hallen et al., 2014). RTC decisions are described in the literature as a process of diagnosis, treatment and rehabilitation for a given illness or injury to determine when the athlete is 'healthy' for participation (Matheson et al., 2011). This relies primarily upon effective communication and integration between staff (Dijkstra et al., 2016). Similarly, but in reverse, this will apply when players need to be removed from training/competition as part of squad management. Injuries may present with symptoms that worsen over time, requiring decisions to protect each athlete's health (Carling et al., 2016). During match congestion when the pressure on support staff and player resources can be high due to the frequency and demand of competition, risk management based decisions become increasingly important (Dijkstra et al., 2016; Carling et al., 2016) to preserve the future health and performance potential of players.

There may also be added pressure to return key players to competition due to the physical demands on squads (Carling et al., 2015a) or for tactical reasons during match congestion (Arkenhead and Nassis, 2016). How effectively PHCTs implement RTC processes will affect the health outcomes of each athlete (Dijkstra et al., 2016), but holding an athlete back deprives the team of PA for competition (Blanch and Gabbett, 2015). The RTC decision-making process is therefore multifactorial, typically specific to each athlete, influenced by decision modification factors (e.g. time of the season or pressure and requirements of the athlete) and can often be taken under considerable pressure (Creighton et al., 2010). These pressures can emerge from many stakeholders including club owners, coaches, media and fans, and have been shown to occasionally lead to conflict between coaches and medical teams (Shrier et al., 2014). Although PHCTs are primarily composed of clinical practitioners (Arkenhead and Nassis, 2016; McCall et al., 2016), a shared process of decision-making between the player, coaches and in some circumstances the senior board members in football may also be necessary, due to the inherent risks of re-injury or continued illness (Hallen and Ekstrand, 2014) and potential ramifications related to sponsorship, media and wider stakeholders (Creighton et al., 2010). For these reasons, the outcomes of PHCT work may in part be impacted by the wider organisation within which they work and the ability of their structures and processes to manage the contextual pressures inherent in this sport.

The hierarchical nature of football clubs suggests that the experience and wishes of the coaching staff will play a role in the decision-making process. This has been reported by practitioners in a study across an array of sports (Arnold et al., 2017) and in football specifically, where the head coach has been reported to have the final say on significant decisions that can include training and competition workloads as well as player selection and rotation (Arkenhead

and Nassis, 2016). For PHCTs to have influence on decisions taken by the head coach, they need the support of the coaching staff and what has been termed 'head coach buy-in' and effective communication (Arkenhead and Nassis, 2016). This may be further complicated by the likelihood that the head coach and coaching staff have different priorities to PHCTs during match congestion, when they are most predominantly focussed on winning (Ashton et al., 2016).

The inherent risks that are present in many PHCT decisions also underline the need for PHCTs to be structured with appropriate expertise and be able to work interdependently, making full use each practitioner's skill set. This has been shown to enhance teamwork effectiveness across multi-disciplinary medical teams outside of sport that are focussed on very complex tasks in highly pressured settings (e.g., accident and emergency departments and operating theatres) (Amour et al., 2005; Bower et al., 2003). However, members of *multi-disciplinary* teams can tend toward decision-making only within their own scope of practice, which reduces the potential of 'appropriate' shared decision-making across a range of tasks (Nancarrow et al., 2013). A team's structures (e.g. expertise, resources) and processes (e.g. shared decision-making) are central to shared decision-making across a range of teamwork studies conducted with multi-disciplinary health care teams (Jaca et al., 2013). The relationships between shared decision-making and outcomes of *multi-disciplinary* PHCT work are currently unknown, as they have not been reported in the literature and therefore warrant dedicated investigation using the knowledge gained from other domains.

2.19 Theoretical Framework Models: Applications to Teamwork Research

Teamwork effectiveness research outside of the sporting domains has largely been guided by theoretical models that have developed over approximately five decades of investigations (Lemieux et al., 2002; McGrath, 1964). These models have shaped significant knowledge advances in teamwork effectiveness and continue to provide a platform for future knowledge gains across a variety of teams. In sport, reference to framework guided teamwork research is scarce; however, a number of editorials refer to support service structures and processes that are typical of teamwork models (Dijkstra et al., 2014; Opar and Rio, 2015).

In forwarding an 'Integrated Performance Health Management and Coaching Model' (Figure 1) based on the preparation that underpinned the track and field performances at the London 2012 Olympic and Paralympic Games, Dijkstra and colleagues refer to the structure and organisation of *multi-disciplinary* support teams as a strategic priority (Dijkstra et al., 2014). Their editorial concluded that optimised systems (team processes) facilitate a more effective teamwork approach to the maintenance and improvement of PH in elite athletes, when compared with less integrated traditional practices. In this instance, traditional approaches are described as a 'reductionist' approach to performance health management, where each discipline works predominantly in isolation and where collective decision making is limited (Dijkstra et al., 2014).

The authors illustrated the model to describe how the structure and processes of staffing arrangements can be used drive integration, communication and understanding between all disciplines, with case managers (e.g. heads of physiotherapy, rehabilitation or strength and conditioning, coaching) changing based on whether an athlete is available for competition or not. When an athlete is injured and unable to fully participate, the coaching team are kept well informed of the status of the athlete hence, their departments overlap with that of the performance health management team (figure 1).

This is reported to have led to more successful decision-making between the *multi-disciplinary* support team specialists and subsequent medal successes. However, the relationship between the described teamwork structures/processes to the performance outcomes (i.e. medals), were not determined by rigorously implemented investigation and remain observations that emerged from the authors' experiences. Similarly, the authors claim that it is well recognised that a support team's structures can affect performance, but little is offered to substantiate this statement.

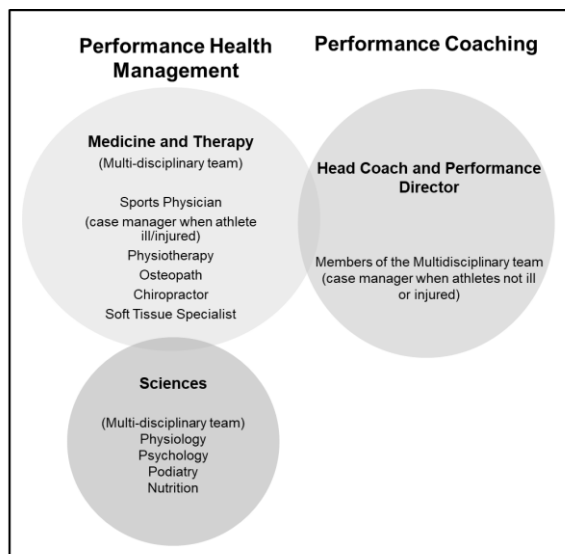


Figure 1: Integrated Performance and Health Model (adapted from Dijkstra et al., 2014).

Note: Both the performance management and coaching departments work in synergy but where necessary, independently. All departments are depicted as overlapping another department despite being recognised as separate teams.

Teamwork effectiveness research has been driven by 130 or more theoretically driven framework models which have focussed on industries and organisations (Kozlowski and Ilgen, 2006; Salas et al., 2008). To reflect the complexity of

teams in *multi-disciplinary* settings, these models are largely based on an Input-Process-Output model (IPO) proposed by McGrath (1964) (Figure 1).

This model was derived from a need to consider the impact of teamwork effectiveness on health outcomes and the efficient use of resources (Liedtka and Whitten, 1998), or to better understand factors involved in organisational productivity (Barrick et al., 1998). In the IPO model, the development of teamwork is conceptualised as a process shaped by the composition and characteristics of the team (inputs), the interactions that team members are engaged in (processes), and eventual products of team activities (outcomes) (Jaca et al., 2013). In turn, the composition and characteristics of a team are illustrated to act as antecedents, situated to support the 'team processes' that describe the team members' interactions during tasks.

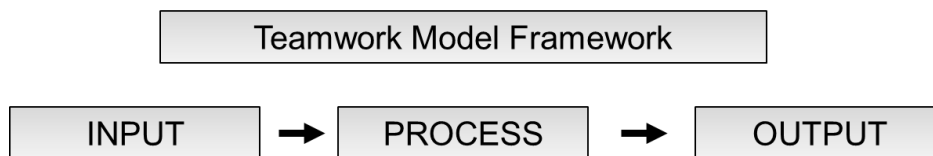


Figure 2: Early Input-Process-Output Model (adapted from McGrath, 1964).

Note: The Model depicts three important considerations for teamwork research; Inputs (e.g. human resources, knowledge, technology), Processes (interaction between group members) and Output (task and non-task consequences e.g. productivity, team member satisfaction).

Team processes are therefore depicted as transformers of the 'inputs' into 'outcomes' which are the results and by-products of team activities (Mathieu et al., 2006). This early model's frameworks lacked temporal elements to reflect the development of teams or reflect team learning that can impact outcomes of their work which in practice can be considered fundamental to the teamwork processes.

Cohen and Bailey (1997) conducted a review of team and group research literature 1990-1996, marking a significant turning point in the interpretation of teamwork effectiveness. This review identified and categorised a variety of types of teams (work, parallel, project and management) and evaluated their effectiveness based on multiple outcomes (quantity and quality of outputs, member attitudes and behavioural outcomes). These authors concluded that research focused on teams until this point in time suggested that teamwork effectiveness could be predicted from a function of environmental and design factors, group processes and psychosocial traits (i.e. group level phenomena e.g. shared mental models or shared understanding of the tasks).

Mathieu and colleagues, in their review of teamwork effectiveness 1997-2007, reported that Cohen and Bailey's review had been cited over 550 times within a decade of its publication and had reformed the interpretation of teamwork effectiveness models (Mathieu et al., 2008). Arising from this, the IPO model was adapted and extended to include feedback systems for team learning (group level psychosocial traits), environmental factors, and temporal elements that reflect team development over time (Kozlowski and Ilgen, 2006). As a consequence, the IPO model has been largely replaced by what has been

termed “input-mediator-output models” (IMO) that depict processes that unfold as a team matures (Jaca et al., 2013) (Figure 3).

Inputs (antecedent factors such as member composition, characteristics of the team and organisational context) are still divided into the three groupings but are nested to show an interactive pattern between the characteristics of the organisation, team and individual members.

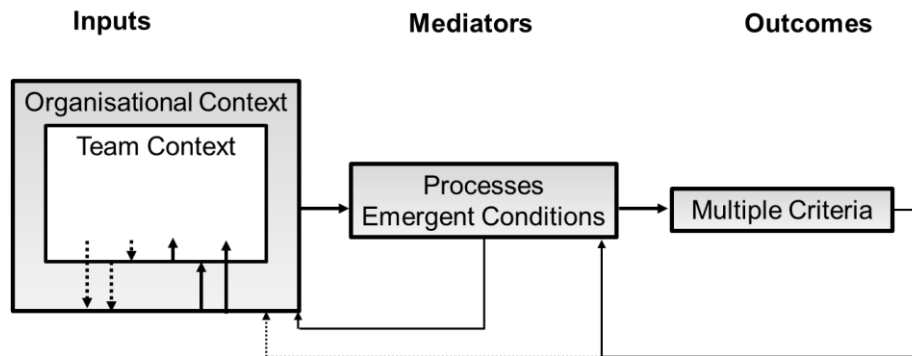


Figure 3: Input Mediator-Outcomes Model (adapted from Jaca et al., 2013)

Note: Solid lines linking teamwork outcomes to teamwork mediators (illustrate learning that results from feedback or recognise the evolution from each team experience to another). Recognition is also given to the influence that outcomes and mediators have on input factors (dashed lines) (Ilgen et al., 2005).

Cohen and Bailey (1997) highlighted this as important to reflect the multilevel nature of team inputs. These researchers considered individuals as grouped in teams, which in turn are embedded in organisations which exist in specific and sometimes changing environments. The arrows in figure 3, emphasise the flows of influence that these layers can have. With the experience gained from organisational studies, Cohen and Bailey classified teams according to their task type, tenure (duration of time in development), interdependence and autonomy (e.g. intensive care unit teams were considered to have very short tenure and work cycles and have memberships which were considered very changeable or unstable). This was important because these considerations have implications for team structures, processes and outcomes of teamwork (Jaca et al., 2013) and provided subsequent researchers with a foundation upon which a variety of teams could be considered including those in health-related care and therefore sport.

Based on an extensive review of the healthcare team effectiveness literature between 1985-2004, Lemieux-Charles and McGuire (2006) produced the Integrated Team Effectiveness Model (ITEM) based on the IMO model, providing a framework for conceptualising relationships between multiple dimensions of teams’ task design (context and structure), team processes, team psycho-social traits and team outcomes in healthcare (Figure 4). Inspired by the work of Cohen and Bailey (1997), the model therefore widely considers the multiple dimensions of a team’s constructs by describing them in detail and classifying them according to attributes, e.g. task type, team duration, purpose, interdependence or autonomy (Lemieux-Charles and McGuire, 2006). Team

processes (e.g. decision-making, communication and collaboration) are separated from team psycho-social traits (e.g. cohesion and problem-solving effectiveness) which are considered group level phenomena that are linked to task design and ultimately outcomes. Several teamwork factors are grouped under task design, team processes and team psycho-social traits, which are considered to work at team, system or organisational levels (Reeves et al., 2010). Together these teamwork factors determine teamwork effectiveness, accounting for the socio-political context in which the team exists, the organisational context in which the team is doing its work, the task design, team process and the psycho-social traits of the team.

As a model the ITEM can therefore be tailored to the investigation of a variety of teams, facilitating the analysis of teamwork effectiveness by considering each team's task design and structure, team processes and both subjective and objective outcomes of its work. It is upon this basis that the model provides a significant advance on previous theoretical models and one that could be applied to sport-based support teams.

The layered format of the ITEM provides a sound basis for the analysis of teamwork and consideration of its perceived or objectively determined outcomes. In the context of health services, outcomes are central to applied research (Valentine et al., 2011) and the same can be argued for sport, where competition success and athlete health are important outcomes.

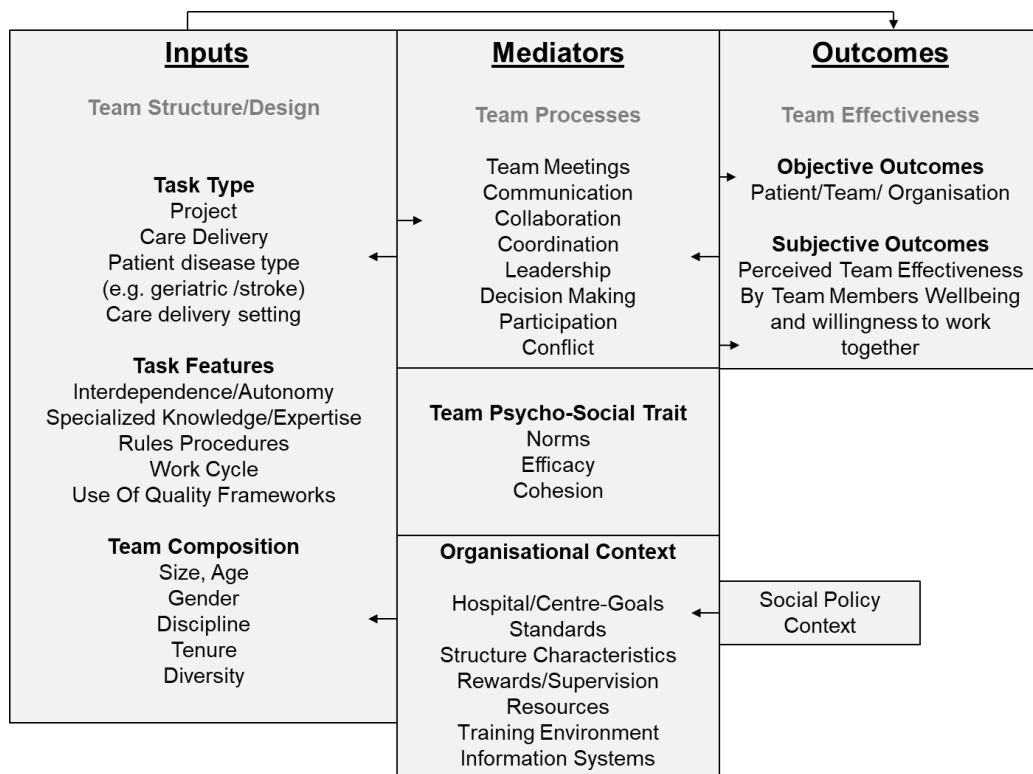


Figure 4: Integrated Team Effectiveness Model (adapted from Lemieux-Charles and McGuire, 2006).

These theoretical models have enabled research to more fully determine the dynamics and inter-connectedness of team structures, processes and outcomes that support teamwork effectiveness. This was demonstrated in a study to determine whether 42 English general practice teams' structures (measured using binary, categorical and continuous variables; single handed or partnership led practices, team size i.e. number of staff, mean length of employment of staff; booking intervals for patient consultations and others) predicted group level team processes (team climate i.e. shared vision/objectives, participative safety) and outcomes (quality of disease management, patient evaluations of practice and self-reported ratings of effectiveness) in primary care settings (Bower et al 2003). Team process was assessed through a 65-item measure of team 'climate' (using a team climate inventory) which represented shared perceptions of organisational policies, practices and procedures (psychosocial group level processes e.g. participation, reflexivity, clarity of objectives, teamworking objectives). The scores of individual members were aggregated to provide an overall team climate score, based on the mean of the individual team members. Outcomes were assessed using a previously validated 21 item healthcare team effectiveness scale (Poulton and West, 1993) and by using the 53 item, General Practice Assessment Survey self-report questionnaire which assesses multiple dimensions of primary care from the perspective of the patient (including access, technical care, communication, interpersonal care, trust, knowledge of the patient, nursing care, receptionists, continuity of care, referral, coordination of care, patient recommendation, and overall satisfaction). The main findings from this study were that both structure and processes were related to outcomes at two levels. Practice structure, favouring single-handed structures as opposed to partnerships, predicted 41% of the variance in team climate (regression coefficient: $B=2.38$, 95% CI 1.47 to 3.29) and, team processes (i.e. team climate scores) accounted for 16% of the variance in patient evaluations of practice (regression coefficient: $B=1.35$; 95% CI 0.43-2.26). Based on a quality assessment project, this study highlights the utility that IMO models can bring to the investigation of teamwork effectiveness. A direct effect of the team structure on outcomes was not determined using the data available (moderation or mediation statistical analysis) despite structure-process-outcome model presented in this study illustrating a clear link between these two (input-outcome) teamwork factors. This may be important clinically because larger partnership teams, may have a wider range of clinical skills but might not benefit if the climate does not encourage interdisciplinary practices and sharing of tasks. Nevertheless, from a clinical perspective, 'team climate' was found to represent an important mediator of teamwork effectiveness across the English health authorities.

A common thread in this and many other teamwork effectiveness studies is the idea that the group structures and processes are associated with the full use of available individual expertise to optimise teamwork effectiveness. This expertise has been described as 'team intelligence' and should amount to the sum of each individual's contribution and abilities (Mayo and Woolley, 2016). However, Woolley and colleagues (2010) have challenged this notion. They investigated the possibility that 'group collective intelligence' (a measure of the general

effectiveness of a group on a wide range of tasks) might not be the sum of its parts. In order to do this, 63 individual participants were randomly assigned into teams of three in a laboratory setting. The participants were required to perform a variety of tasks both individually and within their teams, upon which they were rated. Tasks included brainstorming, solving visual puzzles, making collective moral judgements, and negotiating over limited resources. Collective intelligence scores were only moderately related individual members' average intelligence score. Group individual scores or the highest individual member scores were not significant predictors of team performance. When team members used a method, which required them all to contribute to the team conversations in a certain order (conversational turn taking) within their groups (to ensure whole group contributions), the scores for each task were positively correlated ($r=0.41$; $P < 0.01$) with the group collective intelligence. The researchers suggested that the collective ability of a team will depend upon its composition and factors that emerge from the way the group members interact. Importantly, the authors did not report the backgrounds of participants used in the study or whether the volunteers for this study were previously known to each other. The generalisability of these findings may therefore be limited because, in practice, specialists within teams generally work and learn together as the team matures (Xyrichis and Lowton, 2008). Nevertheless, maximising group intelligence alongside appropriate team processes would seem to be a powerful tool for teams attempting to maximise their effectiveness and worthy of consideration in teamwork research.

Subsequent to the works of Woolley and colleagues, similar findings were found across a range of organisational studies however, group composition and expertise must allow and support a willingness of all members to contribute to the team, irrespective of status (Engel et al., 2015). The works of Engel and colleagues (2015) are well supported by theoretically developed frameworks including the ITEM, which position team structure (including team composition) and team processes (contributions, interactions) as antecedent to teamwork outcomes and important to collective intelligence and team performance. These teamwork studies indicate that practitioner specialist skills are important but equally will be impacted by how well these skills and knowledge are collectively applied, illuminating a range of considerations for research focussed on PHCTs who, to date have not been considered in this way.

2.2 Teamwork Factors and the Integrated Team Effectiveness Model

Teamwork factors provide a frame of reference for analysing contributors to teamwork effectiveness. The ITEM separates these teamwork factors according to a teams' task design (practice structure), team processes and outcomes that result from teamwork that in essence may have relevance to a variety of teams but have been more specifically applied to healthcare.

The task design and structure of a team refers to its organising framework, which provides a foundation for the system in which team members are embedded (Heinemann, 2012). The ITEM reflects findings in field studies which indicate that teamwork effectiveness is impacted by the structures of both the

organisation in which the team works and the team itself (Henemann and Anotonette, 2012). Task design, which incorporates a number of subcategories (Figure 4), constitutes the structural make-up of professional teams and the environment or organisational context in which they work. For instance, the team premise (e.g. offices, geography of working bases) was considered important in several studies that recognised their relationship with information transaction, communication and team familiarity (Molyneux, 2001; Rutherford and McArthur, 2004; Wiles and Robinson, 1994). Having separate work bases can result in members being less integrated with their team, which can have negative implications for subsequent team effectiveness. This was demonstrated in a study of community midwives in one family health service authority in England, whose main clinics were held in several locations away from the team's base (Wiles and Robinson, 1994). The midwives emerged as the least integrated members of primary healthcare teams based on their perceptions of teamwork effectiveness conducted using semi-structured questionnaires. Recent changes in primary health care services because of legislation were highlighted as contributing to a shift in working practices, supporting the view that organisational context and structure is an important consideration for perceived teamwork effectiveness and commitment to shared objectives (Henemann, 2012). PHCTs may also suffer from these issues that can emerge from having widely spread training ground bases (described as premise within ITEM) to incorporate all members of a team or to serve players in differing locations for performance and or health matters. Similarly, PHCTs may also have to withstand changeable working arrangements due to the typically short duration of head coaches and coaching staff with whom they work resulting in an unsettled and changeable working environment (Relvas et al., 2010).

Team size has been related to several factors impacting a team's effectiveness. In one study of 68 primary healthcare teams in the UK, it was found that larger teams seem to have lower levels of participation and communication than smaller sized ones (Poulton and West, 1999). This study sought to determine the relationship between team composition, processes and teamwork effectiveness and found that team size was negatively correlated with participation ($r = -0.33$, $p < 0.05$). The authors suggested that larger teams may find it more difficult to foster participation, which may inhibit shared decision-making. However, in a study investigating the effectiveness of 72 breast cancer teams in England, larger teams demonstrated better patient outcomes (e.g. better accuracy and timely diagnosis) (Haward et al., 2003). Despite this study focussing on the proportion of nurses involved in multidisciplinary team services, it suggests that the number of professionals involved in multidisciplinary teams does have relevance in teamwork effectiveness. How this may relate to the number and size of PHCTs in football remains to be seen. It could be that teamwork effectiveness is also affected by the size of each PHCT, which are reported to be ever growing (Drust and Green 2013).

In organisational studies, an alternative view is offered where the size of a team is deemed to impact communication frequency, which is an indicator of the

information processing activities amongst team members. Patrashkova and colleagues (2003) conducted studies with teams from 25 corporate and government organisations operating in aerospace, automotive, public utilities, electronics, and communications industries. Results showed that when levels of information processing increased (the average frequency with which a team uses a particular communication medium, such as face to face, email, telephone), so did each team's effectiveness (project goal achievement; staying within estimated cost goals; and staying on schedule). This relationship held until a point where such exchanges overloaded the capabilities of team members and inhibited their performance. A curvilinear relationship between team size and effectiveness has therefore been proposed, suggesting that up to a point, increasing size improves a team's effectiveness but beyond that has negative effects (Patrashkova-Volzdoska et al., 2003; Cohen and Bailey, 1997). This is supported by research conducted with 172 manufacturing employee teams within a single company, which investigated the impact of team size on group cohesion and integration (Miklavcic et al., 2007). In this study, smaller teams (<15) showed higher levels of cohesion/integration and productivity as well as better communication, relationship quality (inside and outside of work) and better collective learning/team knowledge creation than groups that had up to 45 members. This was concluded to stem from more productive interpersonal relations within smaller teams based on levels of positive emotions and attractiveness/agreeableness, and because smaller teams had fewer isolated individuals or groups forming within each team that detracted from collective tasks. Although this qualitative case study may have limited generalizability, it illustrates important considerations regarding team size, learning and group level cohesion that are of interest to all teams working in stressful environments, including football.

'Team diversity' has also been considered an important factor within a team's structure across healthcare teams and support structures within elite sport. Team diversity refers to the degree of difference between members' professions, training, capabilities and experience (Campion et al., 1993). To illustrate its relevance to football, Pain and Harwood (2007) investigated the performance environment of England youth football teams following tournaments. In this study, interviews with national coaches, sports science personnel and players revealed several factors deemed to impact performance during tournaments. Eight dimensions emerged, including the diversity of practitioners that contributed to planning and organisation, the physical environment, tactical factors, performance philosophy, and psychological, physical and social factors (Pain and Harwood, 2007). Similarly, Arnold and colleagues (2015) found four key factors perceived to be essential for effective preparation for the 2012 Olympic Games that included the planning, operations, environment and the delivery team. The structure of multidisciplinary support teams, as well as the specialist and diverse specialist skills that staff were able to develop through their tenure (staff had a minimum 4 years of experience working with Olympic athletes), were considered essential by athletes and preparation camp organisers. These factors are consistent with those factors highlighted in ITEM as important 'inputs' to a team's composition and structure.

In healthcare settings where caseloads are high, specialist knowledge through tenure has also been shown to develop in those teams attached to specific patient populations (e.g. breast cancer), resulting in clinical efficiency and better patient care (Haward, 2003). When support teams are multidisciplinary in nature and hence have a diversity of skillsets (e.g. health visitors, general practitioners, district nurses, councillors, physiotherapists and midwives) a more holistic view of each patient case is considered contributory to positive patient outcomes (Mirjam, 2010). Team diversity contributes to specialist knowledge, resources, work cycle, expertise and ability to collectively command greater support from the wider organisation in which a team works (Jaca et al 2013; Mathieu et al., 2006). However, having a wider array of skillsets may only be useful when the team is willing to encourage and share information (Xyrichis and Lowton, 2008). This can be important because increasing specialisation of professions and their involvement in multidisciplinary teams requires greater understanding between professions and a recognition of roles to avoid conflict (White et al., 2013). Sargeant and colleagues (2008) drew similar conclusions, having conducted focus group research across a range of healthcare professions. Their findings highlighted that effectiveness in diversely populated teams required members who respected each other's roles, had role clarity, were familiar with the team's framework or guidelines (e.g. interdependent practice to tasks that crossed disciplines in primary care) and were willing to share information readily. This is consistent with findings across the social sciences that have investigated team size and potential conflict (Roncaglia, 2016).

The ITEM also illustrates that the wider organisational context or structural characteristics within which teams are embedded, can have roles to play in their teamwork effectiveness. For example, the support received from the wider organisation within which teams operate are implicated in teamwork effectiveness (Borrill et al., 2000). This may take the form of supervision, provision of resources and investment in infrastructure. This illustrated within IMO models that have nested team members within team context and, in turn, organisational context (figure 3). Reviews of the teamwork literature have recognised the process of team learning, reflective activities and subsequent innovation/change as intrinsically linked to the wider organisational support that a team receives (Xyrichis and Lowton, 2008). In their ten-article review of factors that inhibit or facilitate interprofessional teamworking in primary and community care, Xyrichis and Lowton (2008) found that the process for developing new and improved ways of doing things was identified as impacting teamworking in 60% of studies and was reliant upon external organisational support. However, without organisational support for innovation and recognition of staff ideas, teamwork effectiveness may decline over time, with staff becoming disillusioned in highly stressful healthcare settings (Borrill et al., 2000). How a team is supported and incentivised was acknowledged by the UK Department of Health white paper (DH, 2005) which recognised that limited support often led to frustration and conflict amongst patients and staff with undesirable outcomes for patients.

Continuing support for PHCTs may be equally important in professional football, where these teams typically work under an executive board including a director of football and club manager (Relvas et al., 2010). The continued growth and investment in PHCTs (Drust and Green, 2013), would suggest a high level of organisational support exists in football which, ideally, would include provision of all resources deemed necessary for the optimisation of performance and health. However, given the season-long performance and health demands of managing large squads (Carling et al., 2015) and the wider concerns (e.g. club profitability) faced by board and senior members in football clubs (Relvas et al., 2010), this relationship between PHCT and the football club may not be straightforward.

Collectively, these task design and structural factors would seem pertinent 'inputs' to a PHCT. Despite limited generalizability in some of the literature supporting ITEM, the framework provides a basis for further understanding PHCT structures which act as important antecedents to its processes. An example of this is provided by the reference to a team's size and subsequent information transaction/communication i.e. team processes (Miklavcic et al., 2007) which, have also been demonstrated to be important for the effective functioning of support staff across a range of elite sports (Arnold et al., 2017). Communication is essentially a team process, which a team's task design and structure plays a role in shaping.

2.21 Team Processes

The Input-Mediator-Output format within ITEM, indicates that each team's structure can be considered an antecedent to its teamwork processes (Heinemann and Antonette, 2002). This is supported by studies which have demonstrated that appropriate structures can only be translated into positive outcomes if the team processes are effective (Bower et al., 2003; Landry et al., 2015). Underpinning an interpretation of teamwork effectiveness is a recognition across 43 studies reviewed by Xyrichis and Lowton (2008) and Lemieux and McGuire (2006) that a team's processes (communication, coordination, collaboration, decision making, participation, leadership and psycho-social traits; cohesion and norms) are significant processes that shape most teamwork outcomes. Organisational studies also acknowledge these collaborative processes as important in situations where a broad range of professionals are required to engage in shared decision-making (Kellermanns et al., 2008). PHCTs find themselves in such a position, where a broad knowledge base and shared decision-making have been deemed the optimal way to manage a range of activities including training load prescriptions (Charlton et al., 2017) and the return of athletes to competition from injury (Hallen and Ekstrand, 2014; Dijkstra et al., 2016). However, it is currently not known if shared decision-making is related to the teamwork effectiveness of PHCTs.

In the ITEM, Lemieux and McGuire (2006) depict an interdisciplinary team climate as one in which healthcare practitioners participate together with clarity of objectives, support for innovation and a commitment to quality. This interdependence has been deemed fundamental to collaborative processes,

particularly those that require shared decision-making. Interdependence has therefore also been described as the hallmark of teamwork, when team members are truly reliant upon each other and the team develops a synergy that facilitates its functioning and productivity (Fairfield et al., 2004). The degree to which practitioners/professionals work closely is reflected in their team processes, which have been shown to vary between multidisciplinary and interdisciplinary team approaches (Roelofsen et al., 2001). Investigating group level processes in hospital paediatric rehabilitation meetings, Roelofsen and colleagues used a questionnaire sensitive to changing processes that are inherent in multidisciplinary and interdisciplinary team meetings. The study identified that entirely different decision-making schemes support each of these approaches. During interdisciplinary team meetings, participants have to achieve consensus about subsequent goals/objectives and practices across participating professionals. In contrast, during multidisciplinary meetings, members only inform others about their goals and objectives (Green, 1980; Roelofsen et al., 2001). An interdisciplinary 'team approach' was therefore deemed to require significantly more collaboration, integration of knowledge and shared decision-making processes beyond that seen in multidisciplinary teams (Roelofsen et al., 2001). This raises questions about the teamwork approach of PHCTs and how it influences the outcomes of their work. If team processes are deemed central to teamwork effectiveness, then understanding the PHCT's approaches to teamwork should be considered important.

Mirjam (2010) compared multi- and interdisciplinary team approaches to teamwork effectiveness (team performance and staff satisfaction) in German rehabilitation clinics. A multidisciplinary team approach in this study occurred when team members remained discipline-oriented, and all professionals worked in parallel with clear role definitions, specified tasks and along hierarchical lines of authority. In the second instance, an 'interdisciplinary model' differed in that professionals worked collaboratively along non-hierarchical lines, meeting regularly to discuss and set goals for patient care (Mirjam, 2010). Two groups were selected that were representative of either a multi- or inter-disciplinary approach. Teamwork effectiveness outcomes (measured using a psychometrically validated questionnaire (Kauffeld, 2004) were found to be consistently higher (overall team model, Eta squared effect size $\eta^2 = 0.022$: $P = 0.008$) for achievement of objectives, task accomplishments, cohesion, willingness to accept responsibility, workplace atmosphere, leadership, organisation and communication when an interdisciplinary approach was adopted. These findings are supported by similar teamwork studies also focussed on rehabilitation, where interdisciplinary modes of operation are shown to produce better outcomes than multidisciplinary approaches (Gafà, 2005; Shaw, 2008). Given that rehabilitation is also an area of practice for PHCTs when returning players from injury, it is possible that similar relationships and outcomes could prevail in the football environment. This would suggest that for a PHCT to use a multidisciplinary approach to manage performance health would be less than optimal, and potentially not as favourable for PA.

Despite 'communication' emerging as a teamwork factor from studies focused on a team's task design, within ITEM it is considered a teamwork factor most central to a team's processes. Described as 'the glue that holds teams together and enables collaborative work' (Sargeant et al., 2008), communication has also been recognised as a risk factor for injury in football by the leading medical officers in Europe's most elite football clubs (Ekstrand, 2017). In this instance, the suggestion is that poor communication between support teams in football is linked with outcomes that relate directly to the availability of players for competition. These suggestions emanate from leads within medicine departments of clubs who work at the highest levels of European football on a daily basis, however, the views of other members of the support team were not considered in these works and may differ from those expressed by the lead medical figures within each club.

Discipline specific language, especially within diversely populated multi-disciplinary teams, can be problematic if less open and inclusive communication is adopted (Molyneux, 2001). This may in part result from the greater specialisation of professionals within healthcare and corresponding fragmentation of disciplinary knowledge. This was also the conclusion drawn from a systematic review of interdisciplinary teamwork that was combined with the perceptions of care team workers within the NHS across the UK (Nancarrow et al., 2013). According to Opie (2000), "the beginnings of shared linguistic practices" marks the development of an interdisciplinary team. This was most eloquently demonstrated in a study that differentiated the language used by interdisciplinary (described in this study as interprofessional) and multidisciplinary teams focussed on physical assessments and rehabilitation in hospital wards (Sheehan et al., 2007). A wide array of staff composed these teams including consultants, physiotherapists, nursing, occupational therapists and psychologists. An interprofessional team was characterized by its use of inclusive language, continual sharing of information between team members and a collaborative working approach. In the multidisciplinary team, the members worked in parallel, drawing information from one another but without a common understanding of issues that could influence interventions focussed on rehabilitation (Sheehan et al., 2007). Although this study did not consider the outcomes of each teams' work, it highlights most importantly how communication is linked to the teamwork approach. Given that PHCTs are also populated with practitioners from a variety of professions (Drust and Green, 2013), discipline specific language may also be an important consideration in teamwork effectiveness in this environment.

Teamwork approaches have ultimately been linked with better outcomes across organisational and healthcare studies (Lemieux-Charles and McGuire, 2006) and are proposed by Dijkstra and colleagues (2014) as a strategic priority in sport. With the widely varied disciplines that can compose PHCT staff, it is plausible that inclusive language will also be a hallmark of an interdisciplinary approach to teamwork related to outcomes of their work. This is supported by a study that revealed inadequate communication amongst support staff was perceived as significant stressor and negatively associated with staff

performance across an array of sports, including premiership football (Arnold et al., 2017). This provides a scarce but important link between communication and outcomes of multi-disciplinary teamwork in research focused on sport and with reference to football.

Xyrichis and Lowton (2008), in their review of factors that foster or prevent interdisciplinary teamwork, identified the 'team meeting' as an important juncture for collaborating teams. *Multi-disciplinary* teams in healthcare use meetings to communicate by pooling information, exchanging opinion and negotiating through interactions with members (Kane and Luz, 2011). Several researchers have also highlighted the regularity of team meetings as an important and consistent feature of high functioning healthcare professional groups that achieve better patient outcomes (Haward et al., 2003; Shortell et al., 2004). This is consistent with medical consensus statements, which highlight the multidisciplinary team meeting as playing a critical role in communication between specialist practitioners of medical practice (Prasad et al., 2017; Travis et al., 2013). The importance of *multi-disciplinary* team meetings (MDMs; meetings with professionals from differing backgrounds) is further highlighted by a systematic review of patients with gastrointestinal malignancies. This review suggested that MDMs changed the diagnoses formulated by individual physicians in 18.4–26.9% of evaluated cases. In two further studies, MDMs formulated an accurate diagnosis in 89.0 and 93.5% of evaluated cases for patients with a GI malignancy, and nine studies described that the treatment plans were altered in 23-42% of evaluated cases (Basta et al., 2017). Treatment plans were not only altered in these studies due to comorbidities, but also due to a need to include the patient's wishes in any course of action. Football squads with their performance and health plans can arguably be considered analogous to the patients in these medical settings. Both require the management of their complex issues to reach desired outcomes that are likely to be impacted by the teamwork that occurs between the specialists responsible for treating them. Given that PHCTs often have to manage a squad of 26 or more players (Carling et al, 2015), The 'team meeting' might also be an important event for information transaction as it is in healthcare, although this has not been reported in the literature. A detailed 'clinical sessions' or multidisciplinary team meeting in football that includes relevant practitioners and coaches discussing each player's case would arguably be beneficial for the same reasons as in other healthcare settings. However, it is not known whether this is possible to achieve in the football context, or whether it is manageable during important phases of the season (e.g. periods of match congestion). Nevertheless, the use of 'team meetings' to investigate team processes, offers a valid means for gaining important insight to their impact on teamwork effectiveness that is practical (Kane and Luz, 2011) and potentially amenable to PHCTs in football.

A considerable amount of communication may also occur outside of meetings and this can have significant impact on organisational teamwork (Pentland, 2012). In a study that equipped teams from a broad variety of projects and industries (comprising 2,500 individuals in total; innovation teams, post-op

wards in hospitals, customer-facing teams in banks, backroom operations teams, and call centre teams, among others) with wearable electronic sensors to collect data on their individual communication behaviour (tone of voice, whom they talked to and how much/how long), it was found that the most important predictor of a team's success was its communication patterns (Pentland, 2012). In fact, communication outside of formal meetings predicted one-third of the variation of team performance such that the adopted policy in many of these organisations was for team members to have synchronised break schedules to optimise these patterns of communication. It is quite conceivable that busy schedules, such as during periods of match congestion, may also impact meeting frequency and even communications that occur between PHCT practitioners. In football, PHCTs have to manage a number of different elements simultaneously including away matches, injured players, non-selected squad players and visits to consultants. It is most likely that communication both inside and outside of meetings will be important in this context, but the degree to which this would impact outcomes of PHCT work particularly during match congestion remains unknown. The work of Pentland (2012) represents one of few studies to track participants outside of meetings, likely because of the intrusive nature of such research which in many domains would be difficult to repeat.

Evidence also suggests that it is not just the amount or format of communication that allows teams to succeed, but also the direction in which it flows (Mei-Ling et al., 2008). Mei-Ling and colleagues demonstrated that 'bottom up' communication plays an important role in team effectiveness, where members within a team must be able, comfortable and willing to communicate freely so that higher quality decision making can take place during team meetings (Mei-Ling et al., 2008). This is supported by organisational communication literature, which suggests that a common barrier to effective communication and collaboration is top-down hierarchies (hierarchical leadership directing members) (Pirnejad et al., 2007; Dansereau et al., 1987). Sutcliff and colleagues' research with nursing practitioners concurs that communication failures in medical settings arise from challenges relating to hierarchy, where role conflict, ambiguity and struggles with interpersonal power can emerge (Sutcliff et al., 2004). Nevertheless, top-down communication also has its benefits and in football it can be considered the natural direction of flow when leadership is a significant factor for performance (Cruickshank, Collins and Minten, 2015). PHCTs managing large squads will require significant information flow between the head coach, supporting coaches, players and other PHCT members in order to co-ordinate roles, foster conditions for the implementation of programs, and for knowledge creation and sharing. This has been demonstrated in hierarchical team sport settings (American football and ice hockey), where communication becomes a defining feature of efficiency, effectiveness and success (Erhardt, 2014). Research across a variety of industries has demonstrated a range of psychological, social, organizational and structure/system factors impact information flow including status, trust, supervisory supportiveness and psychological safety (Mei-Ling et al., 2008; Syed, 2016). Despite information flow amongst support teams in sport receiving

rather limited attention, these works demonstrate potential implications for PHCTs unable to communicate information that needs to be received, respected and acted upon by final decision makers such that PA is not adversely affected.

Communication plays an important role in the development of team 'cultures' that underpin high performance in a variety of professional sport teams (Cruickshank, 2012). Culture has been described in professional football as 'capturing the essence of the organisation's aims and working practices through its people, and how stakeholders of the organisation represent and transfer values into working practice' (Eubank et al., 2014). The ITEM illustrates cultures as team norms/standards, i.e. factors that shape the way a team interacts and behaves. Communications of culture typically originate with board members, head coaches and performance directors who have responsibility for driving the organisation and /or team towards meeting its performance aims (Arnold, 2012). PHCTs may also have what has been described as a 'cultural architect' (Eubank et al., 2014) in the form of a sports psychologist responsible for communicating culture. This person, through their interactions, may influence PHCT teamwork structures and processes as would other hierarchical members in the organisation. This is best illustrated during 'change management,' a process that in the football context represents a renewing of the club's direction, structure and capabilities (Cruickshank, 2012). This process normally occurs when a new manager, head coach or performance director is employed to improve performance. This has been described in the literature as 'a programme of change designed to perpetuate beliefs, expectations and behaviours amongst both the players and support staff' (Cruickshank, Collins and Minten, 2015). PHCT structures and processes might be expected to reflect these cultures which ordinarily will have implications for the ways in which PH management is delivered over the fluctuating demands of a football season.

Both cohesion and conflict can emerge over time within groups (Almost et al., 2016). The ITEM model recognises team cohesion to be a group-level phenomenon and an emergent state that arises from, amongst other things, communication among team members (Lemieux-Charles and McGuire, 2006). ITEM acknowledges teamwork effectiveness research which has revealed that *multi-disciplinary* teams are fertile grounds for conflict but paradoxically can also be quite cohesive. When barriers to communication are manifested by the inability of practitioners to openly listen to other professionals' perspectives or to tolerate or trust each other in the pursuit of a common aims, then conflict is likely (Roncaglia, 2016). This is inherent in those studies that have found teamwork to be challenging when conflict is not appropriately managed often by leadership (Brown, 2000; Mesmer-Magnus & De-Church, 2009). Practitioners often bring expertise and associated confidence in their own opinions that stem from longstanding experience, training and knowledge (Shoebridge, 2015). However, working in a team, charges practitioners with integrating advice from different disciplines, and at this juncture difficulties can occur with the potential to impact teamwork negatively or positively (Chatalalsingh and Reeves, 2014; Roncaglia, 2016). Professional boundaries within multi-disciplinary teams may

need to be more permeable and flexible for teamwork to be successful. It has therefore been argued that higher levels of cohesion and appropriately managed conflict are necessary to translate to higher perceived effectiveness (Temkin-Greener et al., 2004) and better patient objective outcomes in healthcare (Almost et al., 2016). Similarly, teamwork studies have recognised that both dysfunctional conflict and a lack of cohesion between team members, in part due to workplace stress, can have negative implications for healthcare on a variety of levels including quality of patient care, employee job satisfaction, and employee wellbeing (Patton et al., 2014). Given the typically stress-laden and fast paced working environments of football (McDougal et al., 2015), this could also reflect the experience of PHCTs, given the multi-disciplinary nature of practitioners that compose them and the high frequency of matches and workplace stresses that they must endure (Arnold et al., 2017).

In studies that have investigated the working arrangements of support staff within English professional football, an absence of clinical autonomy has been cited for clinicians and physiotherapists (Waddington, 2002b). This has been reported to result in conflict between clinicians, managers and coaches regarding treatment approaches (Safai, 2003). Similarly, but not with reference to football, an editorial by Opar and Rio (2015) highlighted the complexities and challenges of interdisciplinary support teams working in high pressured sporting environments, with an emphasis on managing conflict. In this paper, which focussed on practitioners in Australian sports medicine, the support team is described as a 'physical performance team, sometimes representative of juxtaposition between science and medicine'. Reference is made to this team diversity resulting in robust debate, particularly between medical (doctor/physiotherapist) and performance (sport scientist/strength and conditioning coach) teams that at times is '...fierce and one eyed'. The authors consider that much of this has resulted from ideologies being juxtaposed, whilst recognising it has advantages when evidence-based opinions can be combined with astute leadership (Opar and Rio, 2015). This potential differentiation of ideology between medical and performance related practitioners illustrates the importance of team processes for PHCT work. Should badly managed and unproductive interactions between support staff coincide with periods of match congestion, important aspects of PHCT work may negatively impact the shared decision-making processes and effective interdisciplinary work. This is because effective shared decision-making relies upon appropriate communication, collaboration, participation and interdependence amongst staff (Manser, 2009). Should these sub-optimal interactions result in less effective decision-making regarding training loads i.e. incorrect load prescription, the negative implications on one day may be harmful to player health for up to one month (Orchard et al., 2009). If PHCTs are to be effective during a football season, especially during match congestion when both performance and health are most challenged, their ability to remain cohesive and appropriately manage conflict will likely favour the outcomes of their work. This may in part be determined by appropriate leadership which in both organisational and healthcare research has been considered to play an important role (West et al., 2015; Lemieux-Charles and McGuire, 2006).

Leadership is included as a mediator and team process within the ITEM due to a number of studies consistently pointing to its importance to teamwork effectiveness (Armstrong, 2007). West and colleagues (2005) define leadership as a relationship through which one or more people influence the behaviour of others. Multidisciplinary healthcare teams reviewed under the ITEM have highlighted that leadership plays a key role in managing instabilities such as conflict, shaping team culture, promoting team learning and maintaining team performance (Lemieux-Charles and McGuire, 2006). The task of leadership is to ensure direction, alignment and commitment within teams such that there is agreement on shared visions, values and strategy (Drath et al., 2008). In a cross-sectional study by Shipton and colleagues (2008), leadership and team climate were related to organisational performance across the NHS. This study involved 86 hospital trusts run by the NHS in the UK and found leadership effectiveness ratings were positively correlated with higher clinical governance and commission for health improvement ratings (Multiple regression: $\beta = 0.42$, $p < 0.05$; $\beta = 0.37$, $p < 0.05$, respectively) and fewer patient complaints ($\beta = -0.57$, $p < 0.05$). This means that the more positively staff rated the leadership with whom they worked, the better their performance. Notably, 98% of the relationship between leadership and patient complaints in this study was explained by the care quality climate (defined as shared perceptions of organisational policies, practices and procedures). The authors concluded that leadership had a significant role in creating an appropriate climate to support a variety of teamwork outcomes in the NHS, which is a target driven environment. This is one of few studies to link leadership with organisational outcomes in healthcare and although causality cannot be attributed from results in this cross-sectional study, the results help shape a number of questions regarding leadership and PHCTs. It could be that the heads of department or directors of football that have leadership roles within football clubs (Relvas et al., 2010) impact PHCT outcomes in similar or alternative ways. This would be particularly pertinent during periods of match congestion where competition drives the objectives of PHCT activities, although it may also depend on the relationships between staff members, which in Shipton and colleagues' (2008) work was not clearly described.

Leadership has also been shown to provide members of multi-disciplinary healthcare teams with direction that ensures organisational objectives are clear and agreed upon (Borrill et al., 2000). When team members agree upon their goals and objectives, guidance is provided for teamwork behaviour and for this reason teams can be defined by their shared objectives (West and Lyubovnikova, 2013). Poulton and West (1999) found that having clear and shared objectives had the biggest single effect on primary healthcare team effectiveness. However, West and colleagues (2013) have argued that in their healthcare and organisational research (which has spanned over a decade) it is not uncommon to find team members who are unclear of the group objectives, making interdependent working difficult and outcomes of teamwork sub-optimal. ITEM does not explicitly list goals and objectives, but teamwork research has highlighted its importance (Mathieu et al., 2008; Xyrichis and Lowton, 2008;

West and Lyubovnikova, 2013). This suggests that future studies of teamwork effectiveness should consider additions to the ITEM framework to incorporate additional teamwork factors.

Team audit (often reported as evaluation), represents another teamwork factor often related to leadership, which has become recognised as important process. Audit also forms the basis for appraisal, evaluation, feedback and learning, offering the opportunity to incentivise team members and improve team functioning (Xyrichis and Lowton, 2008). This was demonstrated in a study that investigated human resource management practices in relation to team performance in 61 hospitals in England (West, 2002). This qualitative study concluded that evaluation and appraisal (aimed at clarifying employees' work goals/objectives, evaluating training needs and providing feedback in order that performance can be improved) had a strong relationship with patient mortality (standardised regression: $\beta = -0.47$ $p < 0.001$). The larger and more sophisticated the appraisal system used, the lower the level of patient mortality. In this same study, teamwork (% of staff working in teams) also had a strong positive association with patient mortality (standardised regression: $\beta = 0.364$ $p < 0.01$). This suggests that team auditing/evaluation has links with outcomes from teamworking, potentially through team learning and adaptation of processes and structures. However, this study is limited by its cross-sectional design that makes cause and effect conclusions limited. Nevertheless, reflexive healthcare teams have been described as 'self-aware', more likely to recognise areas that need attention/development, and hence implement necessary improvements (West et al., 2013). Leadership undoubtedly could play an important role in a team's reflexivity and the way in which teams audit and evaluate themselves.

Ekstrand and colleagues' (2017) study of 36 elite European football clubs found transformational leadership (leadership which involves motivating and inspiring followers to commit beyond self-interest for the benefit of collective interests by providing vision, stimulation, meaning and challenges) by the head coach was weakly correlated with the incidence of severe injury (spearman's rank order correlation = -0.25 ; $P = 0.03$) and accounted for six percent of the variance in those injuries (coefficient of determination $R^2 = 0.062$). The link between leadership and injury was speculated to result from the coaches' influence on player stress, but this was not assessed. Similarly, although unique in its approach, this study was based on the opinions of the medical staff only, which may not be wholly representative of all PHCT members and, in fact, may be influenced by personal relationships with the coach. Nevertheless, there is a clear indication that leadership within a hierarchical football club structure can impact health and, although this study was not about leadership of the PHCT itself, may impact the availability of players for competition.

It is not known whether PHCTs are audited to evaluate their work, as this has not been reported in the literature. Nevertheless, its use as a teamwork factor within a framework model is warranted and, supported by subsequent reviews of multi-disciplinary teamwork effectiveness in health-related care (Xyrichis and Lowton, 2008) and could be applied to PHCTs.

2.23 Literature Review Summary

There is a clear indication in the literature of the growing role being played by PHCTs in the performance and health management of professional football players. However, their employment and practice within *multi-disciplinary* teams, as well as the effectiveness of their work within the organisational context of professional football, has received little attention. The health of football players is central to the performance and economic requirements of each football club, where a key objective is to maximise the availability of players for competition. Hence, the increasing investment in PHCT practitioners is a testament to their considered importance in meeting these aims.

Research has highlighted that a persistent trend of injuries continues in European football, particularly during periods of match congestion and despite a significant volume of research that has illustrated the incidence, risk factors and means of preventing injuries in this context. This raises a number of questions regarding the effectiveness of PHCT work. There is a possibility that their employment is an incidental by-product of football clubs' requirements to access a broad array of services. As a consequence, due consideration of teamwork factors that contribute to a multi-disciplinary team's effectiveness, particularly in highly stressful environments, may have been overlooked.

To the contrary, decades of teamwork research outside of sport has focussed on a wide array of organisational and healthcare related teams to illuminate the barriers, risks and benefits of appropriately considered teamwork practices. A significant finding from these studies has illustrated that combining practitioners from different disciplines in highly pressured environments and expecting them to know how to work in an interdisciplinary way i.e. collaboratively and efficiently together, can have grave ramifications for health. Similarly, these extensive works have developed a widely accepted consensus that frameworks based upon an input-mediator-output model, which includes detailed reference to a team's structure (e.g. task type, team composition and task features) and processes (e.g. communication, collaboration, co-ordination, conflict, leadership, decision-making and participation), can make significant contributions to the understanding of teamwork effectiveness in a variety of settings. With this evidence, there is the possibility that modelled teamwork research of PHCTs would be equally beneficial. To our knowledge this has not been considered before and could provide for a deeper understanding of their functioning and effectiveness.

Several unknowns relating to PHCT effectiveness remain, particularly during match congestion when it is understood that both the players and practitioners are under considerable pressures that can negatively impact their work. Hence, little is known regarding the impact of these competition demands on PHCT structures/processes that may in turn be related to PA. This is despite the leading medical officers within Europe's most elite football clubs reporting significant player health and wellbeing concerns that relate to the internal communication amongst PHCT practitioners, the workload imposed upon players and the head coach's leadership style. The common thread linking

these risk factors to the health of professional football players is that they are all, to varying degrees, influenced by the teamwork practices of the PHCT and central to their teamwork effectiveness. Therefore, the purpose of this study was to investigate a PHCT, through its structures and processes, and to relate them to outcomes (namely PA) using the framework of an adapted and integrated team-effectiveness model (ITEM).

2.24 Research Questions

1. Is there an association between the processes as defined by the adapted Integrated Team Effectiveness Model (ITEM), within an English Championship professional football club's PHCT and both player availability for competition selection and match frequency?
2. What structures exist in an English professional Championship football league club's PHCT, as defined by the adapted ITEM.
3. How does the structure of a PHCT in an English professional football club further inform an understanding of the relationships between its processes and player availability to compete during periods of varied match frequency?

Chapter 3: Research Design and Methods

3.1 Research Overview

A mixed method case study was conducted in a Championship football club during the 2017-18 season to investigate performance health management and its outcomes (Figure 5). The study was conducted through a competitive season in collaboration with support staff whose principal role involved the management and delivery of performance and health support services to professional football players. Using an adapted ITEM, relationships between the structures, processes and outcomes of the practitioners' work were investigated in a sequential explanatory format.

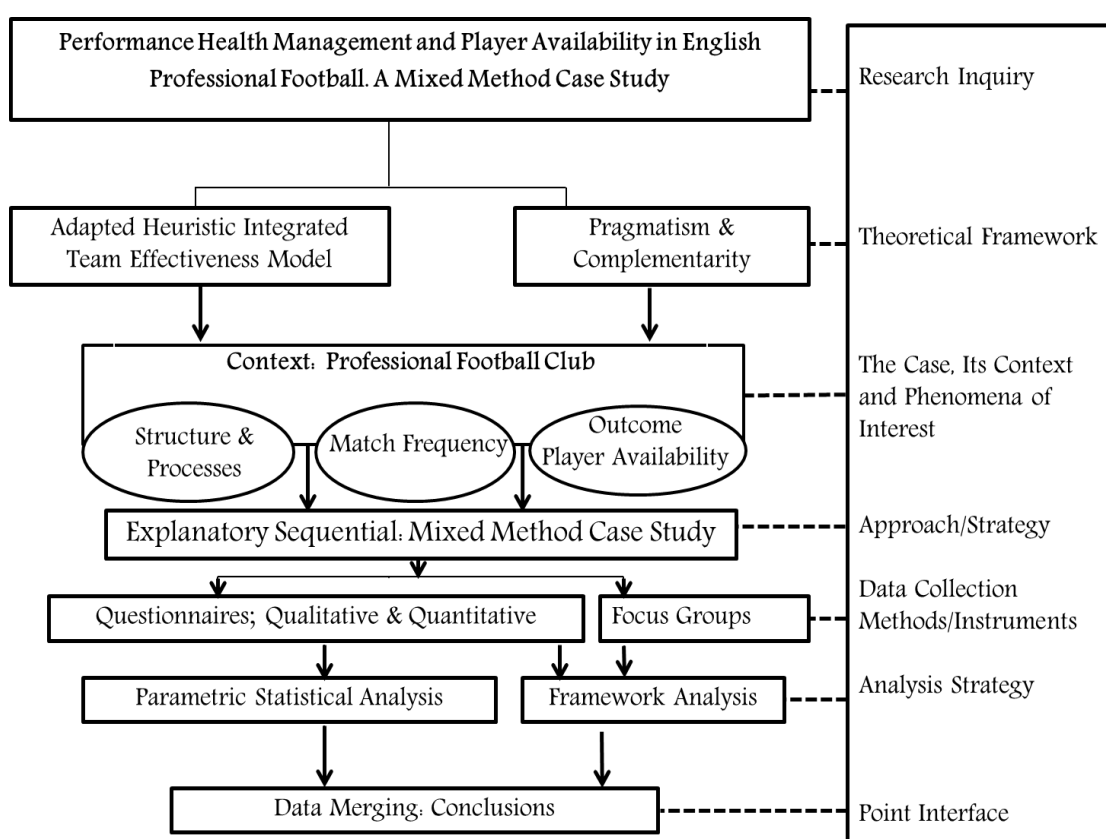


Figure 5: Case Study Design Schematic
(adapted from Rosenberg and Yates, 2007)

3.11 Theoretical Framework and Study Approach

This research was guided by the philosophical underpinnings of pragmatism. This approach is based on the rejection of a one-to-one linkage between paradigms and methods, providing the basis for the use of a methodological mix. This allowed for wider methodological options that could be used to address the research questions in a complex elite sport setting. Although applied research has become increasingly accepted in professional football, the study design recognised that research involving practitioners who manage football athletes competing in what has been described as a highly pressured,

fast paced and volatile sporting environment (McDougall, Nesti and Richardson, 2015), would require a significant degree of flexibility. The case study provided this flexibility, allowing data collection with minimal intrusion to participants that served to support the quality of the data and ease study participation.

The research questions are bounded by potential relationships between performance and health (PH) management structure, processes, player availability (PA) and match frequency within a football club. A sequential explanatory mixed method was adopted because the pattern of relationships that could be revealed through quantitatively collected data (team processes) would require further and a deeper understanding obtained from a qualitative approach. The process therefore entailed the collection and analysis of quantitative data, followed by the collection and analysis of qualitative data to elaborate, explain and support the quantitative findings and to more holistically consider the relationships between variables of interest (Creswell, 2007).

3.12 Ethics Approval

Ethical approval for this study was granted by the University of Bath Research Ethics Approval Committee for Health (REACH; Ref. EP 17/18 03). In all instances the ESRC research framework for ethics was applied to the design, implementation and dissemination of results from this project (ESRC, 2016). Participants in this research were given the opportunity to reflect on whether to participate after considering the full details of the study and were required to provide written informed consent (Appendix 1).

3.13 Participant Recruitment

Access to an English Championship league club was obtained through the existing professional networks of the lead researcher. The proposed study was discussed with the Director of Football, following which a further meeting was arranged with the heads of sports medicine and science, and the head coach. This involved a more detailed explanation of the study aims, requirements of potential participants, and the pragmatic approach being taken with the research.

Support staff that made contributions to the performance, science or medical aspects of the club were subsequently invited to a research meeting. To be included in the study, participants could be full or part time employees of the football club but had to be actively involved with the performance and/or health management of the first team squad. Furthermore, they must have been considered by the head of sport medicine or sport science to be part of their team. However, technical coaching staff (i.e. those considered responsible for the development of the technical aspects of the players) were excluded because the aim of this research was to investigate the PHCT's work. The lead researcher provided potential participants with the purpose, procedures, potential risks and perceived benefits of involvement in the study before seeking informed consent.

3.14 Adaptation of the ITEM

To investigate the PHCT's structure, processes and outcomes, an adapted version of ITEM formed the basis of the questionnaires used in this study. ITEM is recognised as having an integrated framework that can be tailored to specific types of teams and settings (Lemieux-Charles McGuire, 2006). However, for this study, the subsequent works of Xyrichis and Lowton (2008) provide evidence for the need to consider additional items in this framework. These included: information exchange, no. of team meetings, team premise, team goals/objectives and team audit/evaluation. These were incorporated into an adapted ITEM framework (Table 2). Guided by these ITEM components, two questionnaire instruments (Team Process and Team Structure Questionnaires) and a focus group discussion were used to collect quantitative and qualitative data.

Table 2: Adapted ITEM Framework Used to Guide the PHCT Investigation

Team Structure and Design	
INPUTS	<p>Task Type: Management and Delivery of Performance Health Care In Football Club</p> <p>Task Features: Interdependence/Autonomy, Specialized Knowledge/Expertise</p> <p>Team Composition: Disciplines, Size, Diversity, Tenure, Team Premise.</p> <p>Organisational Context: External Support</p>
Team Processes	
MEDIATORS	<p>Team Meetings: Communication, Collaboration, Coordination, Decision Making, Participation, Leadership, Conflict/Cohesion</p> <p>Evaluation, Goals/Objectives</p>
Teamwork Effectiveness Outcomes	
OUTPUTS	<p>Objective: Player Availability</p> <p>Subjective: Perceived Effectiveness</p>

3.15 Study Organisation

A project assistant working within the club as a placement student provided administrative support during the study where necessary, and a research observer aided during qualitative analysis to verify and provide rigor to the procedures. All data in this study was collected over two phases of the football season (Table 3), where **phase 1** (quantitative data) was collected in-season and **phase 2** following the end of the competitive season. The lead researcher recorded field notes throughout the study that included both descriptive (what was observed, heard and experienced) and reflective notes (thought processes, learning and ideas, speculations, impressions and connections made).

Table 3: Stages of data collection during the study

Phase of Season	In-Season (October 2017- May 2018)	Post-Season (May 2018)
Data Collected	Quantitative: Team Process Questionnaire	Qualitative: Team Structure Questionnaire/Focus Group Discussion

The team process questionnaire was completed twice monthly such that data was generated to representative of Part A and B as illustrated in Table 4.

Table 4: Representative stages for the Team Process Questionnaire

Team Process Questionnaire Representative Days	Part A	Part B
	(1st-15th)	(16th-30th)
April (2), November (2),	15 days	15 days
October (1) December (2), January (2), March (2), May (1)	16 days	15 days
February (2)	14 days	14 days

NOTE: In brackets (No. of data collection time points)

3.16 Player Availability (PA)

PA was recorded by the head of sport medicine on the morning of each competitive match day as the number of players available for selection. This was in line with late medical tests typically used in professional football on the morning of the match, when decisions are made on competition readiness. Practically this procedure maximises recovery time for players and was consistent with the PHCT's established routine of providing this information to the head coach, information officers and board of directors.

The data for PA was collected every two weeks following consultation with the head of sports medicine. Availability strictly included those players deemed eligible to compete in each match as defined by the PHCT. The availability score included those players omitted for technical and rule violations that resulted from suspensions, as they were not ill or injured and therefore considered "available" in the context of this study.

3.17 PHCT Processes

Team process questionnaires (Appendix 2) were given to the PHCT members in person twice monthly, representing the data collection stages in-season between October and May (14 data collections; Table 4). To standardise this

procedure, practitioners had to complete and return the questionnaire to a member of the research team within 10 days of receiving it. Questionnaires not completed within this time frame were not included in the results.

The team process questionnaire consisted of two parts, the first section of which consisted of four domains to assess the quality of team meetings, as per the ITEM (20 items; Table 5). All items were rated on a five-point Likert scale. These were items taken from a previously developed group process questionnaire that was devised to assess the quality of medical team meetings based on the interaction between team members (processes; communication, collaboration, co-operation, participation and decision-making) (Roelofsen et al., 2001). The questionnaire has previously demonstrated good internal consistency and structural validity in medical rehabilitation settings (Cronbach's alpha 0.7-0.84) (Roelofsen et al., 2001). The assumption implicit in this tool is that participants' perceptions of the quality of team meetings are related to the interaction (processes) between team members.

Table 5: Team process questionnaire domains part 1.

Domains	Areas Assessed
Domain 1	Personal Task Participation: the extent to which the individual participated in the discussion (5)
Domain 2	Negative Interaction: the extent to which team members interacted negatively towards each other (5)
Domain 3	Result Satisfaction: the amount of satisfaction regarding the solutions which resulted from the discussion (5)
Domain 4	Process Satisfaction: the amount of satisfaction regarding the discussion process (5)

Number in parenthesis denote number of questions in each domain.

For the present study, the words '**treatment plan**' were changed to '**performance-healthcare plan**' (four questions) to allow participants to consider performance elements of their work, and the word '**patient**' was changed to '**player**' (one question). Roelofsen and colleagues (2001) previously adapted the questionnaire to conform to rehabilitation terminology by changing single words. Item wording can bias responses (Klein et al, 2001), but the changes made in this study are considered minimal and for context only.

During interdisciplinary, as opposed to multidisciplinary, meetings (i.e. differing 'teamwork approaches'), higher scores are expected for personal task participation (domain 1), result satisfaction (domain 3) and process satisfaction (domain 4), relative to negative interactions (domain 2). The computation of 'teamwork approach' indicative of changes in the interaction between PHCT members (from multi to inter-disciplinary) over the course of study, were

calculated as the sum of domains one, three and four divided by domain two. This is in line with the interpretation of the original (Green and Taber, 1980) and subsequent questionnaires (Roelofsen et al., 2001) in order to detect changes in team processes during meetings. Data collected in part one of the team process questionnaire is referred to hereafter as evidence of the 'teamwork approach'.

To account for the ITEM components not assessed by Roelofsen and colleagues (2001), part two of the study questionnaire included seven additional domains (Table 6). These included questions taken from a 'teamwork effectiveness audit questionnaire' developed and originally tested with 140 public sector organisational teams, which including a healthcare sample (Bateman, Wilson and Bingham, 2002). The original questionnaire used a five-point Likert scale and had good internal consistency (overall Cronbach's alpha = 0.98) and domain structure for test items ($r = 0.87-0.98$) (Bateman et al., 2002). In the present study, triangulation of these questions was performed during focus group discussions (study phase 2) to further substantiate responses, provide greater confidence in the findings and to add to the content validity of this section of the questionnaire. When applied in mixed method research, this form of triangulation is regarded as adding confidence to findings across and between research tools (Bryman, 2016).

Table 6: Team Process Questionnaire Part 2.

Additional Domains	Area Assessed (number of questionnaire items)
Domain 5	team goals/objectives (5)
Domain 6	team audit/evaluation (3)
Domain 7	number of team meetings (1)
Domain 8	frequency of contacts between members (1)
Domain 9	frequency of informal/mutual exchanges (1)
Domain 10	personal influence on team decisions (1)
Domain 11	impact of the frequency of matches (4)

Parenthesis to denote the number of questions in each domain.

3.18 Match Frequency

For the purposes of this study, match congestion was operationalised based on match frequency and computed using both the number of hours between consecutive matches and the number of matches played (Table 7). Computed at the end of each month, the lead researcher confirmed the date on which matches had been played with the head of sport science by telephone. Match congestion was defined as a period when there were ≤ 3 days between matches (Bengtsson et al., 2013a), representing a condensed timeframe in which PHCTs could operate.

Table 7: Match Frequency and Congestion Classification

Day	Saturday	Sunday	Monday	Tuesday	Wed/Thurs/Fri	Saturday
Match Number	1			2		3
Kick Off Time	3pm			8pm		3pm
Time Of Finish	5pm			10pm		5pm
Recovery Time Between Matches		75hrs			91hrs	
Total Recovery Days				166 hrs = 6.9 days		
Match Frequency				6.9days /3matches = 2.3		
Classification				Classified Congested match frequency (≤ 3 days)		

3.19 Team Structure Questionnaire

In phase 2 of the study, the PHCT's design and structural components were assessed using a questionnaire. The description of the organisational context in which the PHCT performed its work, task types, team composition and task features, consistent with ITEM, formed the basis of this assessment. This bespoke questionnaire consisted of a variety of question types including open, closed and Likert scale questions (Appendix 3) that were designed to simply discern the organisational context of the PHCT as defined by ITEM.

Question development reflected the ITEM components and the research that led to their generation as a teamwork factor. For example, 'organisational support' as a teamwork factor emerged from research which indicated that team learning, and reflective activities need wider organisational support for innovation and change (Xyrichis and Lowton, 2008). The question was therefore posed: 'To what degree does the wider organisation outside of the PHCT support innovation and change?' Simple question design followed throughout (e.g. to determine the task type according to ITEM for each staff member, one of the questions posed included: 'What was your official position and title this season?')

To gain a thorough understanding of the structures adopted by the PHCT, each participant was provided in person with the team structure/design and context questionnaire seven days after the last match in the season. The time lapse between the end of the season and the provision of these questionnaires was chosen to allow practitioners reflection time on the structures that the PHCT adopted over the course of the season.

Both the team structure and process questionnaires in this study were pilot tested with ten experienced performance and healthcare specialists known by the lead researcher through professional contacts. Each of these pilot participants had more than nine years of experience in professional football in

roles across sports medicine, physiotherapy and sport science. The aim of the pilot work was to evaluate the suitability of the questionnaires in terms of the ease and time required to complete them. The summarized findings of this process are shown in Appendix 4. Minor adjustments to the spacing for responses within the team structure questionnaire for open answer questions were made and the lead titles from the original team process questionnaire were removed in response to feedback. This process also served to support the face validity of part two of the team process questionnaire.

3.2 Focus Group Discussion

A guided focus group discussion was used to gain a deeper understanding of the information provided by the quantitative data collected in-season and to supplement information from the structural questionnaire. The aim was to explore the way in which the PHCT collectively made sense of their work and the environment in which it was conducted. All members of the PHCT were invited to attend.

The focus group was led by the principal researcher (moderator) alongside a facilitator (research assistant) who did not take part in the discussion but took notes and observed the session. An informal venue at the training ground was chosen where the focus group could occur without distraction. The entire discussion was recorded using a digital stereo voice recorder. The lead researcher and facilitator made observational notes to support the verbal data provided by participants. The session was limited to a maximum of 1.5 hours and all participants were encouraged to participate in the conversations.

The focus group used a semi-structured guide to encourage discussion of specific topics while offering flexibility in the conversation between PHCT members. The discussion proceeded by introducing the focus group aims and providing guidelines for taking part in the session. With the use of a discussion guide (Appendix 5), open-ended introductory questions were used to set the scene for the discussions. These were designed to ease the group into the process and build rapport with the moderator. The meeting was then guided by the moderator, to ensure the areas covered in the questionnaires and those indicated by ITEM were discussed. Triangulation of topics already considered in the team process and team structure questionnaires was introduced at points deemed appropriate to the flow of the discussion. The session was concluded once the participants and lead researcher felt that all areas pertinent to their work had been covered.

The final audio recording was immediately transcribed verbatim, with inclusion of time progression, in a Microsoft word document. This was completed by the lead researcher and checked for transcription accuracy by the research assistant. Observational/summary notes were added to the transcript to support subsequent analysis.

3.21 End Season Review

The lead researcher was invited by the PHCT to attend the end season review meeting that the club had organised four weeks following the last match of the season. This meeting had in attendance all full and part time PHCT members (except two practitioners; one soft tissue specialist and physiotherapist), coaching staff, team manager, Director of Football and one Board member. The Director of Football informed the lead researcher that his attendance at the end year review had been suggested by the medical team and that all staff agreed to his presence.

Acting as a non-participant observer, the lead researcher used the opportunity to extend the field notes taken over the course of the season. At the end of the meeting the notes were discussed immediately with the PHCT and Director of Football. This aimed to confirm the researcher's interpretation of the points raised pertaining to the study aims and provide further assurance to the staff regarding the data being taken away from the discussions. This completed final data collection for the case study.

3.22 Quantitative Analysis: Research Question One.

In order to identify relationships between variables (team processes, player availability and match frequency), the quantitative data was subject to Pearson correlation analysis using SPSS software. All variables were computed at the scale level of measurement, meeting the assumption for the level of measurement required for this test.

The data was checked for normality using the Shapiro Wilk test, observation of the skewness values and histograms. Similarly, in order to meet the assumption of linearity and homoscedasticity, both scatterplots and box plots were observed for all variables. Given the small sample size ($N=14$), all correlations between variables were subject to the bootstrap method (BCa) for the generation of confidence intervals (Field, 2018; p273)

The assumption implicit in part 1 of the team process questionnaire was that participants' perceptions of the quality of team meetings are related to the interaction (processes) between team members. This assumption is supported by the previously reported strong negative correlations between the domains 'process satisfaction' and 'negative interactions' for participants using this questionnaire in rehabilitation (Pearson correlation: [Pearson Correlation: $r = -0.74$, $P < 0.01$] (Roelofsen et al., 2001). For the purpose of this study a Pearson correlation coefficient was also computed to confirm this relationship.

Descriptive statistics are presented as Mean \pm SD or Median and Range for data obtained from the team process questionnaires.

Research Question One: Mean scores from the 14 stages of data collection (October-May) were computed for all team process questionnaire domains. These domain scores were then used to determine the strength and direction of relationships with PA for each stage using bivariate and two-tailed Pearson correlations. This included the computation for the association between

'Teamwork Approach' and PA. In order to determine the relationship between the PHCT's 'teamwork approach' (representing interactions of the PHCT members across a spectrum between multidisciplinary and Interdisciplinary approaches) and PA over the course the season, a separate Pearson correlation was conducted. This had to be conducted separately (excluding responses questionnaire part two) on the basis that only part one of the questionnaires can identify this aspect of the PHCT's processes (Roelofsen et al., 2001).

Pearson correlations were also conducted to determine the relationship between MF and all team process.

3.23 Qualitative Data Analysis

The qualitative data from the focus group discussion was addressed using framework analysis, which uses a clear series of steps to interpret the data as previously described by Ritchie and Lewis (2003). This was conducted with specific reference to research question three and to gain a deeper understanding of the PHCT's structure (triangulation of questions posed in the team structure questionnaire) and to explore the relationships between team processes and player PA over varied match frequencies.

3.24 Framework Analysis

The process of analysis involved familiarisation, identifying initial themes/categories, developing a coding index and assigning the data to categories in the coding index (Ritchie and Lewis, 2003). The interconnected stages in this qualitative approach were used to guide the systematic analysis of the questionnaire responses to create descriptive and subsequently explanatory accounts that are consistent with a framework method (Ritchie and Lewis, 2003; Smith and Firth, 2011). This approach was chosen because it provides a sequential and verifiable trail of evidence that is transparent (Rabiee, 2004) and provides orderly steps amenable to novice researchers. An overview of the framework analysis stages is presented in table 8.

The structural components of the ITEM provided prior themes to look for in the data (deductive approach); however, data was not forced to fit these predefined areas and new themes could emerge from the data based on the PHCT's experiences and their assignment of meaning to them.

This integrated (deductive/inductive) pragmatic approach was conducted by the lead researcher and supported by a research observer (experienced with qualitative techniques including framework analysis) who was given access to all materials that emerged from each stage of the analysis for feedback and discussion. The aim was not to reach any form of consensus but to encourage the lead researcher's reflexivity and challenge the process of knowledge construction.

Table 8: Overview of the framework analysis

(adapted from Smith and Firth, 2011)

Stage	Course of Data Analysis					
1	Data Management	Immersing with and getting to know the data: Familiarisation	Identifying initial codes, categories and themes	Developing a coding matrix	Assigning data to themes and categories in a coding index	Continuum
2	Descriptive Account	Summarising and Synthesising	Identifying associations between themes	Developing concepts		
3	Explanatory Accounts	Developing associations between themes and concepts	Reflecting back to original data	interpreting and explaining the concepts and themes	Applying themes and concepts to research question	

A holistic sense of what emerged from the focus group was achieved using a combination of listening and reading repeatedly through the transcripts and audio recording. Notes were taken and kept as support material to progressively summarise areas being discussed that were relevant to the research questions. This summarising process involved the identification of key phrases and the creation of codes (descriptive/conceptual labels) by considering each line, phrase or paragraph of the focus group transcript (plus descriptive and reflective field notes) and highlighting and numbering these areas within the document margins and text. Practitioners' own words were used where possible to stay true to the data (Ritchie and Lewis 2003) and the process was aligned with the question 'what are the participants really trying to describe?' These early thoughts developed into more formal ideas and allowed for the creation of initial categories and a coding matrix using both the transcript and field notes.

Each code initially formed a potential category relating to the structure, processes or outcomes of the PHCT's work and as the number of categories developed, they were grouped together into broader categories. Categories and themes (interpretive concepts) were incorporated into a coding index which organised the data into a meaningful and manageable format. The aim of this process was to identify primary ideas and then framework categories around the key areas of interest to effectively manage the transcript data.

The coding index that emerged from the initial transcript was retested against the data several times using trial and error before the researcher was confident that all relevant information had been considered. The aim was to find the best fit for the data to answer the research questions and to generate an index that would allow easy reference back to the original transcript.

A process of repeated summarising and synthesising refined the initial codes, categories and initial themes to create descriptive accounts. By repeatedly referring to the original transcript, key dimensions of the synthesised data were developed into core concepts. This was performed through a process of moving from initial themes and categories within the coding index and establishing links between what became the refined categories and final themes. This allowed new concepts to emerge during the continued process. The critical thinking that this stage involved is a crucial element in qualitative analysis (Ritchie and Lewis, 2003). To reconcile this importance, the process was tabulated for transparency, illustrating the development of final themes and concepts that form the basic descriptive accounts.

Explanatory accounts were created by revisiting the original data holistically and considering the established literature, particularly as it related to ITEM and teamwork effectiveness. To reduce the possibility of misinterpretation, this was performed alongside the analytical stages (final themes and concepts) and with reference to the research question as is consistent with pragmatism. This ensured that the responses were accurately reflected in the development of the core concepts. The concepts and themes had to make sense of the PHCT's structure and experience of processing their work with respect to relationships with PA. Descriptive and explanatory accounts are presented in the results and discussion section respectively.

3.25 Content Analysis

Descriptive statistics were extracted from the team structure questionnaire based on responses that revealed the PHCT characteristics. The brief open-ended question responses were analysed using deductive content analysis, which is considered an appropriate technique for this type of data (Donath et al., 2011; Hsieh and Shannon, 2005). The steps used in this approach have been previously described (Erlingsson and Brysiewicz, 2017) and included familiarisation, formulating meaning units and codes, and developing categories and themes. Questionnaire formulation had been guided by the ITEM categorisations, allowing the subsequent analysis to focus on how the PHCT responded in relation to the pre-existing concepts recognised within ITEM. The ITEM categorisation therefore provided direction and supported identification of themes. New themes were also allowed to emerge during the procedure and efforts made to stay close to what was said by the respondents, consistent with pragmatism. To add rigor to this analytical process the research observer was also given access to the data such that the interpretation of meaning units, codes and categorisation could be verified and discussed.

3.26 Merging of Data

The quantitative and qualitative data in this study were at first analysed separately and subsequently merged to draw inferences across both. This was accomplished by bringing together study components that answered the relevant research question to illustrate where findings from both approaches converged (complementary information) or appeared to contradict each other

(discrepancy or dissonance). This has been described as an appropriate approach to take in an explanatory mixed method design (Creswell, 2007; O’Cathain et al., 2010) where the quantitative data provides a platform upon which the qualitative aspects of the study further inform the discussion and conclusions drawn from results.

An overview of all analysis and results are mapped for illustration in appendix 8.

Chapter 4:

Quantitative Synthesis of Results

4.1 Questionnaire Return Rates

One hundred and twelve returned team process questionnaires yielded an average return rate of 80% over the course of the season (appendix 6). Of the 28 questionnaires not included in data analysis, 17 (61%) were completed but returned late, therefore not meeting the study criteria, whilst the remainder were simply not returned (11; 39%). Sixteen (57%) of the unreturned questionnaires were representative of periods of match congestion, during which 11 were returned late. One member of staff (the only member who reported duties spread across two squads and worked at two separate facilities) was responsible for ~50% of the questionnaires not returned during these match congested periods.

4.11 Participant Characteristics

Eleven staff initially volunteered for the study; however, one practitioner terminated employment with the club before data collection commenced. Five occasional/part-time staff (yoga teacher, podiatrist, nutritionist, psychologist and reflexologist) opted not to participate. Two general practitioners provided on call 24hr cover for medical matters, one of whom (qualified in sports medicine) was present for match days only, but neither took part in the study. The full-time support staff who participated in the research included nine male and one female participant and this group remained stable in composition during the study. Three physiotherapists, a sports medicine and a soft tissue specialist comprised what was considered the five, sports medicine staff. Within sport science, two exercise scientists, a strength and conditioning specialist and two analysts comprised the five-sport science staffing. Together these ten practitioners comprised the PHCT team.

4.12 Fixtures and Squad Size

The PHCT managed a squad of 25 players between October and January which increased to 28 players for the remainder of the season that followed club purchases and released players. The PHCT worked with these squads in preparation for a competitive match every five days on average (SD=4, range 2-14) throughout the study period and during recovery periods of the season.

4.13 Team Process Questionnaire

Table 9 provides descriptive statistics for participant responses to the team process questionnaire (part one and two) over the course of the season that relate to team meetings. PHCT members reported the highest responses for 'process and result satisfaction' and 'personal participation,' in part one of the questionnaire. For part two, 'goals and objectives,' 'frequency of contacts' and 'informal and mutual exchanges' were reported as the highest amongst other domains.

Table 9: Team Process Questionnaire Domain Responses

Domains	Negative Interaction	Result Satisfaction	Process Satisfaction	Personal Participation	Teamwork* Approach
Median	2	3.5	3.8	3.5	5.3
Range	1.16-2.62	3.32-3.8	3.33-4.58	2.97-3.8	4.06-9.97

Domains	Goals/ Objectives	Audit/ Evaluation	Number of Meetings	Frequency of PHCT Contacts	Frequency Informal/Mutual Exchanges
Median	3.9	2.7	6.5	3.8	3.7
Range	3.5-4.28	2.2-3.3	5.12-9.37	3.11-4.3	3.11-4.1

Domains	Influence on Team Decisions	Impact of Match Frequency
Median	3.2	2.7
Range	2.62-4.11	1.93-3.03

Note: The top table represents responses to questionnaire part one and the second/third to questionnaire part two. Median scores are computed from Likert scale responses (1-5) whereas subsequent correlations are based on mean scores. Number of meetings was reported freely without the use of the Likert scale.

*Teamwork Approach = sum of domains 1,3,4/domain 2.

4.14 Relationships between Team Processes, Match Frequency and Player Availability.

Pearson correlations between team processes, MF and PA (reference to research question one) were computed from the data gathered over the course of the season and are illustrated in table 10.

Table 10 Correlations between Match Frequency/Player Availability and PHCT Team Processes

Research Variables	Match Frequency	Player Availability
Player Availability	0.676**	
Teamwork Approach	0.178	0.533 *
1. Personal Task Participation	0.245	0.02
2. Negative Interaction	-0.155	-0.567 *
3. Solution/Result Satisfaction	0.157	0.411*
4. Process Satisfaction	0.174	0.21
5. Team Goals/Objectives	0.239	0.28
6. Team Audit/Evaluation	0.272*	0.435**
7. No. of Team Meetings	0.14	0.462*
8. Frequency of Contacts between members	-0.288	0.1
9. Frequency of Informal mutual/Contacts	0.139	0.24
10. Personal Influence Team Decisions	0.289	0.18
11. Impact of Frequency of Matches	0.245	0.19

Note: Numbered variables correspond to their domain.

* = $p < 0.05$, ** = $p < 0.01$, two-tailed, N = 14

4.15 Questionnaire Assumptions

There was a strong negative correlation between the domain 'process satisfaction' and 'negative interaction' which was computed to assess whether the perception of the quality of the meetings were related to the interaction between the PHCT members [$r = -0.74$; 95% BCa (-.904, -.391) $p = 0.003$]. This met the assumption underpinning the 'team process questionnaire' part one (Roelofs et al., 2001) and confirmed that this relationship existed within professional football PHCT meetings.

4.16 Player Availability and Match Frequency

During eight of the 14 data collection phases, the PHCT had ≤ 3 days between matches to prepare the squad, representing phases of match congestion. Player availability (PA) averaged $80.6 \pm 4.9\%$ (range 75-89%) over the course of the study. The relationship between PA and MF considering the periods of match congestion are shown in figure 6. Periods of match congestion were computed where the PHCT managed a sequence of three or four matches during the two-week cycles. During match congestion $78.1 \pm 3.2\%$ of the squad were available for selection compared with 84.2 ± 4.7 outside of these periods.

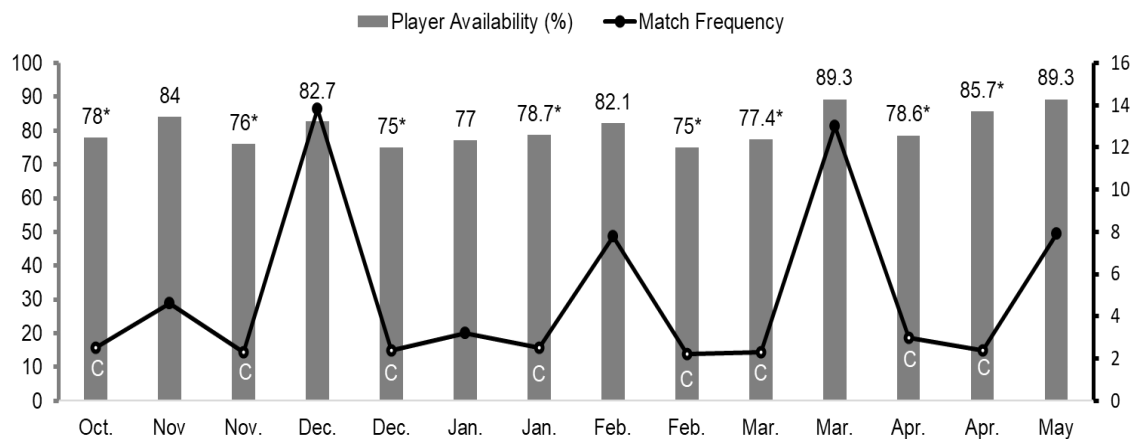


Figure 6: Player Availability and Match Frequency Season 2017-18

Note: Match frequency represented by the number of days between successive matches where match congestion is symbolised with 'C' to illustrate when match frequency ≤ 3 days (i.e. match congested stages of the season). Player availability = % of total squad available for match selection where * also denotes and corresponds with match congestion.

These findings are supported by a strong positive correlation between MF and PA [$r = -0.68$; 95% BCa (.324, .929) $p = 0.008$]. Consequently, when match frequency scores were higher (i.e. when there was more time between successive matches) during the season, more players were available for match selection as illustrated in figure 7.

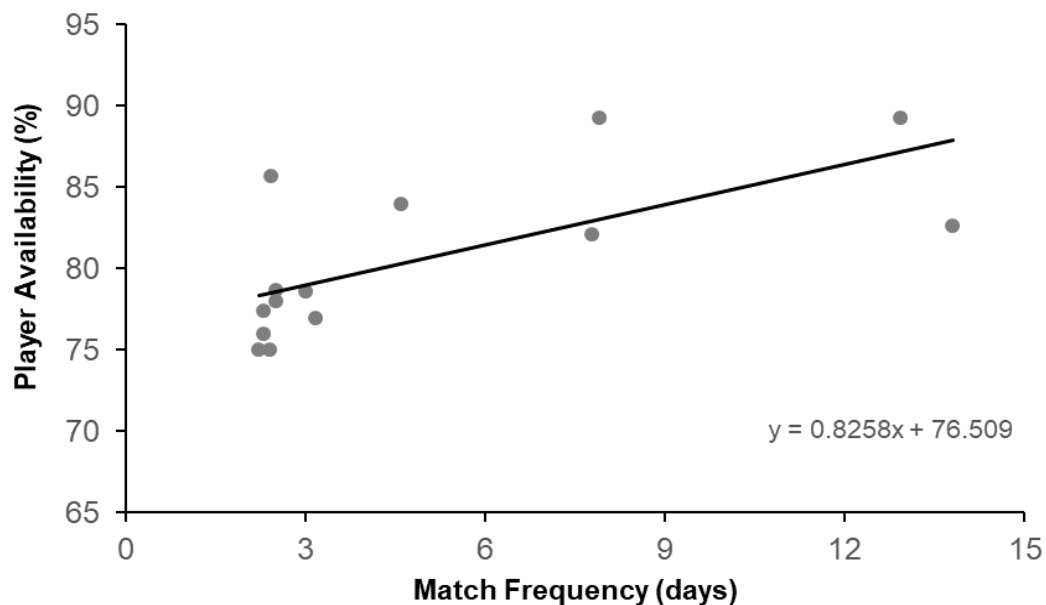


Figure 7: Relationship between Match Frequency and Player Availability

Note: Match Frequency represented by the no. of days between matches

4.17 Teamwork Processes, Player Availability and Match Congestion

The 'teamwork approach' scores varied throughout the study which are illustrated in figure 8.

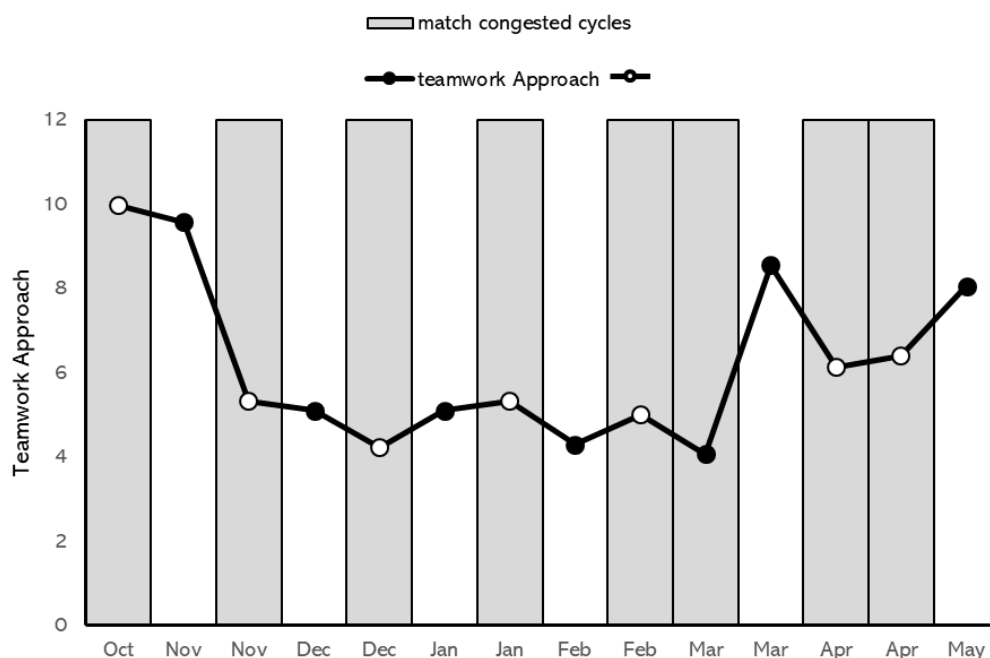


Figure 8: PHCT Teamwork Approach and Match Congestion

Higher and increasing teamwork scores represent greater amounts of interaction between team members i.e. an interdisciplinary teamwork approach. A moderately strong and positive correlation between the 'teamwork approach' and PA was computed [$r= 0.53$; BCa 95% (.087, .888) $p = 0.035$]. Higher teamwork approach scores indicative of interdisciplinary interactions between PHCT members were associated with higher numbers of players available for match selection as illustrated in figure 9.

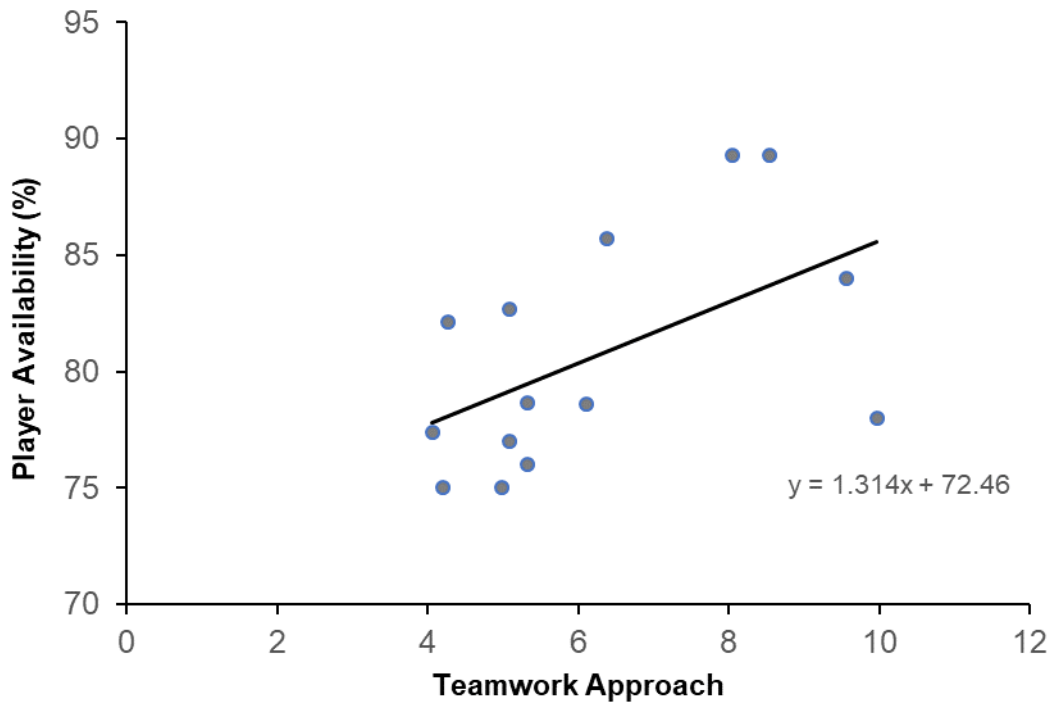


Figure 9. Correlation between Teamwork Approach and Player Availability

The higher the number of PHCT meetings and satisfaction practitioners had with those meetings, were both associated with greater PA. Similarly, increasing amounts of PHCT audit/evaluation of their own work which provided feedback for innovation and change, was associated with a higher number of players being available for match selection. This is illustrated by the finding of moderate correlations between 'result satisfaction' [$r= - 0.41$; BCa 95% (.042, .714) $p = 0.043$], 'team audit and evaluation' [$r= - 0.44$; BCa 95% (.374, .878) $p = 0.009$], 'number of meetings' [$r= 0.46$; BCa 95% (.219, .821) $p = 0.048$] and player availability over the course of the season.

PHCT members interacting negatively towards one another through communicated behaviour, opinions and suggestions during meetings was associated with lower PA, as indicated by the strong negative correlation between 'negative interactions' and player availability [$r= - 0.57$; BCa 95% (-.087, -.097) $p = 0.03$] (figure 10).

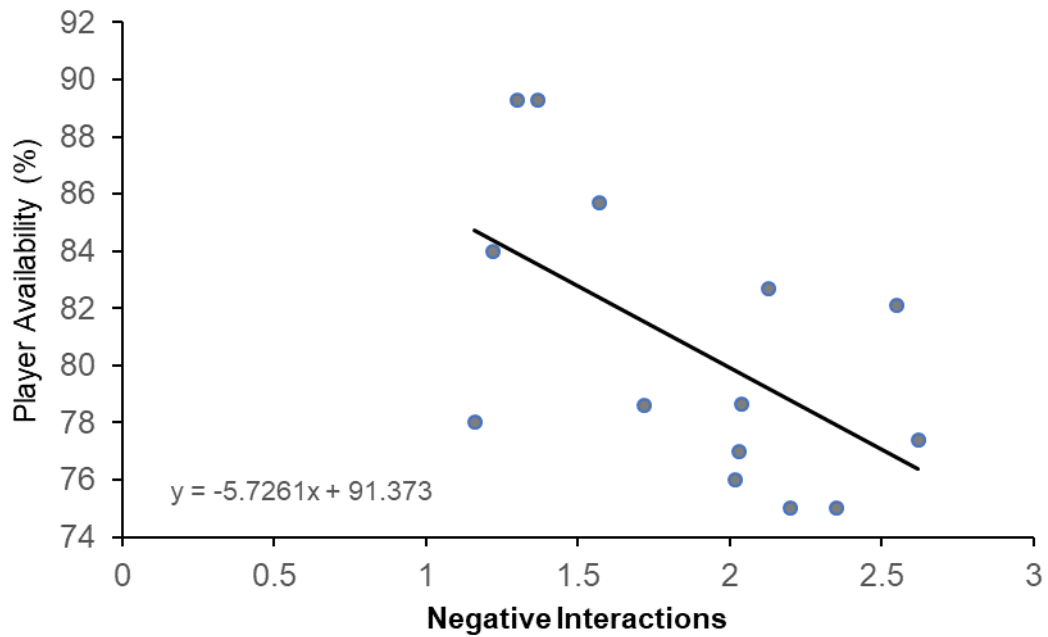


Figure 10: Correlation between Negative Interactions and Player Availability

All other team processes demonstrated limited association with PA and had weak to low correlations ($r = 0.017 - 0.29$; table 10). Similarly, when the association between MF and PHCT processes was considered, weak to low correlations ($r = 0.139 - 0.28$; table 10) were found. Only the relationship between 'audit/evaluation' and match frequency reached statistical significance [$r = -0.27$; BCa 95% (.143, .954) $p = 0.018$] indicating that higher match frequency was associated with the PHCT conducting more audit and evaluation of their work.

Chapter 4

Qualitative Synthesis of Results

4.21 Team Structure

The team structure questionnaires were all returned (100% completion).

Team structure questionnaires that were designed to determine the PHCT's Inputs according to the ITEM (i.e. task type, task features, team composition and organisational context), were completed at least seven days after last match of the season. Open-ended questionnaire responses were assessed through content analysis (formulated meaning units/codes and developing categories and themes) whereas descriptive statistics were used to illustrate other structural features.

4.22 ITEM Task type

All PHCT members confirmed their roles relating specifically to the management and delivery of performance and healthcare. The monitoring of training/match loads, recovery training activities as well as the treatment/prevention of injuries were most frequently cited as their areas of practice (figure 9).

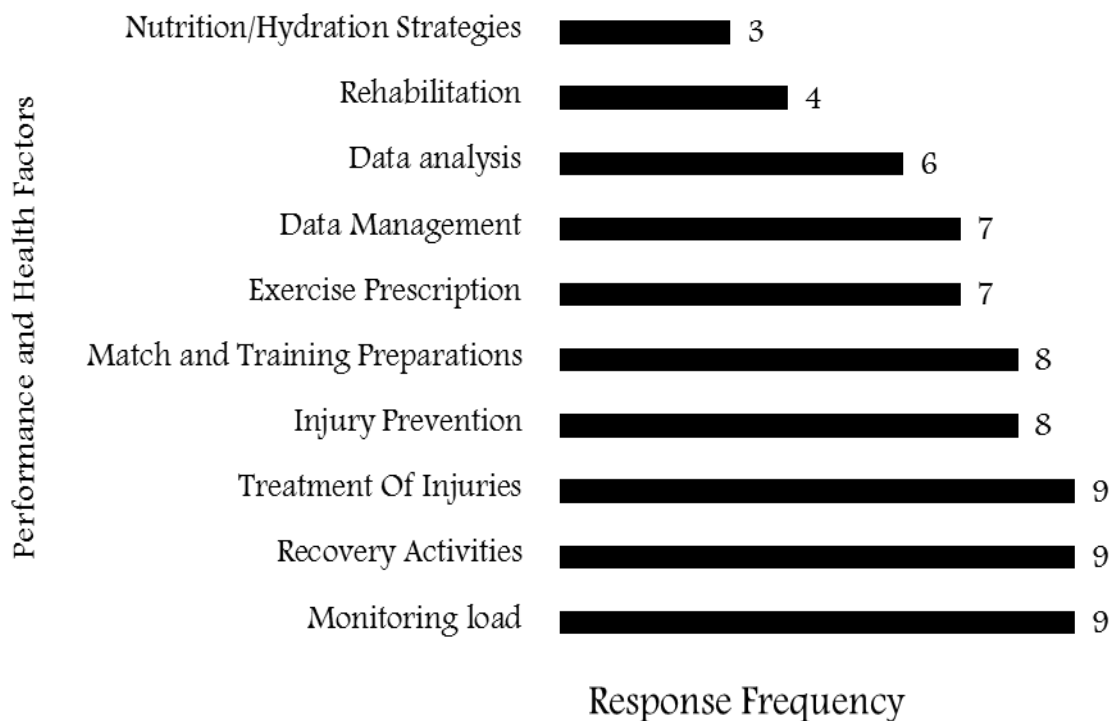


Figure 9. PHCT reported Areas of Practice.

4.23 PHCT Tenure and Composition

The PHCT practitioners collectively reported a tenure within the club of 3.87 years (range: 9 months-6 years), where the sport science and physiotherapy staff had the longest serving members 3.9 (3.6-5.6) and 5.5 (4.2-5.8) years, respectively. The data analysts had completed 2.6 and 5.5 years working at the club. The remaining individual staff members including the head of sports medicine, strength trainer and sports therapist had been in post for 2.1, 2.6 and 8 months respectively.

All but one staff member reported that they worked daily 'in very close [physical] proximity' to other PHCT members. The one exception to this was a physiotherapy practitioner who indicated they were 'quite close' because of their additional duties related to the U23 squad, which required the use of a facility away from the main training area.

4.24 ITEM PHCT Hierarchy

The head of sports medicine and head of sport science acted as leads for their respective colleagues within the PHCT (Figure 10) and were also recognised and had links with other departments within the club including the media and finance. All staff reported to their respective heads of department, who together reported to the head coach and, in the case of sports medicine, also to the Director of Football. +The duties that shaped performance and health management were reported as shared across disciplines, where the sports medicine department predominantly managed the treatment and rehabilitation of injuries and the sports science team monitored training loads and recovery. Data management and exercise prescription were considered shared activities.

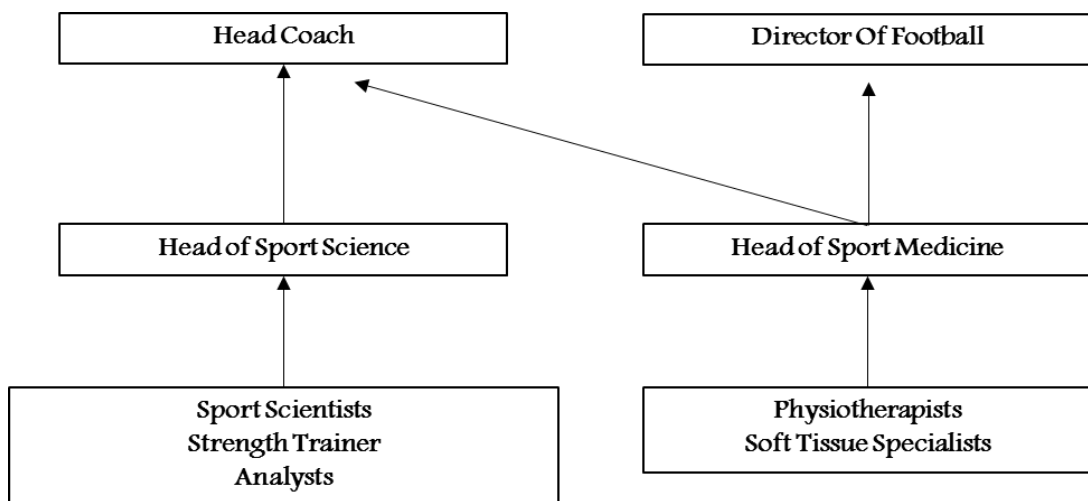


Figure 10: PHCT Hierarchical Structure

4.25 ITEM: Task Features

The need for specialist knowledge within daily duties was reported by practitioners to account for $82\pm 8\%$ of the total work performed. Similarly, practitioners reported their degree of interaction within the PHCT at 86 ± 12.4 .

In terms of the practitioner's disciplinary tasks, three members of the PHCT reported most of their work to be interdependent (reliant upon collaboration) as opposed to autonomous in delivery. This contrasted with four practitioners who reported a predominance of autonomous work and three who considered it to be an equal mix. When collective squad management was considered, 80% of the PHCT responded that they perceived the team's work to be interdisciplinary compared to multidisciplinary in approach.

4.26 ITEM Organisational Context

All staff reported that the wider club organisation was supportive of their needs for further training and technical assistance through a continuing professional development budget. When support for innovation and change was considered, the PHCT responded that this was the case 'to some extent' (64.5 ± 14.1) on a 0-100% scale.

4.26 Team Structure Questionnaire Content Analysis

The primary themes that emerged from responses regarding the impact of match frequency on PHCT structure are illustrated in Table 10. Higher match frequencies resulted in the PHCT having less time to work together and having to work more independently to manage the PH of the football squad. However, this was not recognised as a structural change as illustrated by the following response:

When games go up we have limited time with whole team and tend to work on our own lots more, but structure stays as it was. (Participant 1).

Table 10. Match frequency and PHCT structure

Example Codes	Categories	ITEM Theme
1. working on own more 2. working more independently 3. less time with colleagues 4. less meeting time 5. less staff time together	Independent Practice	Task Features Interdependence Autonomy
1. increased Workload 2. increased injuries/travel 3. reduced time with players 4. less time to respond 5. increased work stress	Task Loads and Demands	Task Features Work Cycle
1. structure consistent 2. team stays the same 3. Infrastructure constant 4. same team working	Team Structure	Team Design Work Context

Respondents believed that an elevated workload due to higher match frequencies led to more injuries during busy schedules:

We have had so many weeks where we play Saturday, Tuesday then Saturday. That has taken its toll on us this year I think with injuries and travel. (Participant 4)

The PHCT's 'work cycle' was altered to manage higher frequencies of matches and injuries. This was cited by 70% of respondents and is illustrated by the following response:

It is ok with two games a week, but three games and we have less meeting time to discuss things, more stress to win games, lots of travelling and always many more injuries. (Participant 7)

The resources (human and technological) available to support PHCT teamwork were directly related to workload:

We work long hours with limited resources and have more stress and less time for each player. (Participant 3)

The practitioners reported roles in PA decisions were categorised under four categories that have been illustrated in Table 11.

Table 11: Key Roles Played by Practitioners in PA decisions.

Survey Question: What roles have you played in PA decisions over the course of the season?		
Example Condensed Meaning Units (Participant no.)	Codes	Category
provide info. on progress of treatments (4) sharing training and match data (1) post-match recovery kinetics (10) support through feedback on recovery and wellness (3)	feedback	Readiness for competition
summarise staff concerns (7) advise on potential for injury (2, 8)	performance and health threats	Risk Assessment
injury prevention programs (5,9) medical interventions (5) manage persistent problems	PH maintenance	PH preservation
training and match load data analysis (8) provide analysis of test results (4,6) Summarise match information (2)	data analytics	Information management

Five practitioners referred to the importance of player recovery, readiness following competition and the risks posed by subsequent competition:

I do a lot of prevention work as well as monitoring and analysis of recovery to advise on the chances of injury, which with some of our players is higher because of ongoing problems between matches. (Participant 5)

Preservation of PH through information/data management was considered of high priority in supporting PA decisions. Further examples of the content analysis are presented in appendix 9.

Chapter 4

Qualitative Synthesis of Results

4.31 Focus Group Discussion

The focus group discussion meeting involving the PHCT practitioners was conducted during phase two (i.e. following completion of all the competitive matches). This provided qualitative data to support the quantitative findings in this research. No competitive fixtures were taking place during this post-season period and practitioners were able to hold discussions fully reflecting on their season's work. Practitioners did, however, report that some players were still receiving treatments for various medical reasons. The discussion explored how the PHCT collectively made sense of their work and the context in which it was conducted such that core concepts and eventually explanatory accounts could be formed.

The PHCT engaged in the meeting for 1 hour and 14 minutes, which allowed sufficient time to discuss a number of predetermined areas according to ITEM, as well as other matters that emerged during the course of the discussion.

PHCT views and collective understanding have been interpreted and described using framework analysis. Descriptive accounts precede subsequent development of 'explanatory accounts' that also consider the quantitative findings. The merging of both quantitative and qualitative results commensurate with mixed methodological research underpinned the formation of 'explanatory accounts' reported in the subsequent discussion section.

4.32 Initial Data Management

Initial management of the qualitative data that emerged from the focus group meeting resulted in 69 initial categories or codes. These categories were framed into a coding matrix, an example of which is presented in Table 12. This coding matrix illustrates an example of the process behind the creation of results from the initial data management, through to the formation of descriptive codes, including the researchers preliminary thoughts and the creation of initial categories. For the purpose of defining the PHCT, eight initial categories emerged illustrating a verifiable and transparent process of their creation, commensurate with the underlying principles of pragmatism. This pattern of analysis and data management was conducted for all other qualitative data gathered and further examples are provided in appendix 7.

Nine themes emerged from the initial categories to support the formation of descriptive accounts.

Table 12: Qualitative Data Management

Part 1: How do you feel about being described as a performance and healthcare team?			
	Descriptive Code	Preliminary Thoughts	Initial Category
..although we are separate its more of one team if you like..'	working as one team amongst teams	collectively operating as a multi-disciplinary team	Working as one team
..the importance of having an holistic approach rather than just five bits of input from 5 different departments..'	considering all expertise	making use of all resources	Considering all inputs
...definitely in the last couple of years its amalgamated a lot more and kind of evolved hmm and kind of working much closer together'	increasingly amalgamated team	collaborative practice increasingly with time	Evolving collaboration between practitioners
we have the same goals and objectives in terms of improving player availability and things like that..'	PHCT goals/objectives	Shared Objectives	collectively supporting PA
yes it's a combined effort trying to bring all expertise to improve health and performance and a good description..'	combining efforts of the team	agreed with term	PH teamwork approach
..going down the route of having a head of performance in place to lead this team..'	head of performance	Lead collaborator	leading an interdisciplinary team
...good balance of skills where there is interaction between staff..'	teamwork	collaborative practice	Practitioners interdependency
..the return to play work defines us as a team, its been really important for us all to work together to try and maximize the resources as a team...'	working collectively	collective practice and return to play	Return to play

4.33 Descriptive Accounts and Core Concepts

The nine initial themes emerged and are presented in Table 13. Themes resulted from the summarising/synthesising of the coded data from transcripts. Seven ‘core concepts’ emerged from these final themes, which were aligned with three dimensions of the adapted ITEM framework (Inputs to Teamwork Structure, Teamwork Processes and Teamwork Outcomes) and presented as follows.

Table 13: Core Concepts Development

Coding Index					
Initial Themes	Initial Category	Refined Categories	Final Themes	Core Concepts	ITEM Framework
Structured interprofessional collaboration	Working as one team Evolving collaborative practice Teamwork and task type Collective duty of care Managing holistic wellbeing	PH Distributed Agency (everybody has a role)	PH Inter-professional collaboration	Structured Inter-professional collaboration	Teamwork Process
	Results driven teamwork Collectively improving PA	Purposeful Teamwork	Directed Teamwork		
Specialist Skills Requirements	Teamwork leadership Knowledge and expertise Understanding the football environment	Functional knowledge and expertise	Professional Specialisation	Contextual Competencies	Input To Teamwork Structure
	Managing performance pressures Interpersonal skills Non-technical skills		<i>Task Features</i> Interpersonal skills		
Department Structure	Practitioner diversity Staff composition Close practice geography Team premise	Functional structures	Team Composition (ITEM)	Structural Interdependency	Teamwork Process
	Practitioner interdependency Interdependent player support				
Practitioner Dependency	Linked system processes (injury prevention) Shared objectives	Structured Inter-professional dependency	Teamwork Reliant Practice		
	Return to play requirements following injury				

Team social traits	Cohesive climate of team support				
	PHCT harmonious nature	PHCT inter-relations	Inter-personal relations	Cohesiveness	Teamwork Process
	Open Communication				
	No competition between staff				
Workload distribution	Practice Efficiency				
	Split focus between performance and injuries	Distributed Resource Allocation			
	Resource Implications				
	Workload Spike		Work Cycle (ITEM)	Resource Workload Capacity	Input To Teamwork Structure
	Organisational structural support				
	Work cycle	Cyclical Workload Management			
Travel workload					
Match frequency workload					
Decision Making	Squad management meetings	Shared Decision Making			
	Load management				
	Consistency of Practice (w/l)		Performance and Health Judgements	Inter-professional decision making	Teamwork Process
Teamwork Outcomes	Decisions on training load	Informing decisions			
	Head coach decisions+ notes				
	Managing health	PH Outcomes	Squad management Objective Outcomes	PH management outcomes and evaluation	Teamwork Outcomes
	Dealing with Injuries				
Dealing with results					
PHCT Evaluation	Goals/Objectives of PHCT	Teamwork appraisal	Evaluated teamwork effectiveness		
	Process Reflection				
	Reflective practice				

4.34 Core Concepts Emerging from the Focus Group

Structured inter-professional collaboration The participants considered their primary role to be the management of performance and health aspects of the football squad through collaborative practice. There was an overriding view of themselves as working as one team, despite there being two main departments:

It's historically been the medical side and sport science side but definitely in the last couple of years it's amalgamated a lot more and kind of evolved... hmm... and kind of working much closer together, working as one team. (Participant 3)

Everyone needs to come together between the departments and take that to management of players with regards to the player availability and performance aspects of things. (Participant 1)

Practitioners reported the football environment being results-driven and their need to support performance. Simultaneously, they observed a need to recognise the holistic wellbeing (physical, physiological and psychological) of players and their own collective "duty of care." To meet this challenge, both policy and practice were prioritised toward structures supporting inter-professional collaboration, integration of knowledge and expertise. This is illustrated by the following quote:

It's been really important for us all to structure, plan and work together to try and maximize the resources we have got. We haven't got great amount of staff here and, we haven't got great facilities but what we do is make the most of what we've got. And what we really have got is members of our team working together to maximize performance. At the end of the day that is what we are aiming to do whether that's from a medical side, physical science the emotional side and then the sport performance side. (Participant 3)

The practitioners recalled that they had been working together for four to five years and that their collaborative practices were evolving and becoming increasingly amalgamated. This represented an ongoing refinement of their teamwork processes as their collective experience and team tenure increased. The practitioners recognised that this was not typical of the football environment where backroom staff were typically very temporary due to the volatile nature of English clubs. Similarly, they referenced the fact that head coaches often employed their own medical and sport science staff when joining a new club, but in recent years this had not been the case, allowing the PHCT to develop as a group.

Central to their PHCT collaboration was reference to the importance of team meetings. Meetings were seen as an important juncture in their "squad management" where prior work was reviewed and, subsequent work was planned collaboratively:

Meetings are really important for us we discuss every day with the injured players as of what's going on. Without a discussion you get chinks in the armour and you don't know what's going on....we have within the Physio Dept a meeting on a daily basis, really that is informal about the injured players and then there will be a meeting with (***)named person) and the sports science team about the load and their input and how they can help us. (Participant 7)

Participants considered these meetings as central to the co-ordination of support services, without which they might be unable to effectively manage the squad:

I do think it's really important and I also think to get everyone together and talk about things especially if you've got a difficult case or a difficult player is important. You are thinking how can we change things and I think that's what is really good about our team is that in medical and sports science we are happy to bounce ideas off each other to learn and get the best possible plan in place for the players for their rehab. (Participant 3)

It's like trying to herd cats when working with professional footballers...so the more organized we can be then the easier that makes it especially with our performance and recovery programs and so meetings become vital. (Participant 4)

The practitioners recognised that a learning opportunity arose from these meetings in addition to the role that they played in squad management.

Structural Interdependency The participants spoke about situations where the PHCT's composition as well as the facilities within which they worked had affected the content and delivery process of their support (e.g. not being able to satisfy the requirements of foreign players). This generated some debate within the context of busy match cycles where players that had joined the club from outside of the UK were deemed to have different expectations when compared to the 'English' players. The differing expectations between players was considered to further complicate practitioners' squad management across a range of practices including the use of external consultants, how rehabilitation was conducted (e.g. the number of staff expected to be involved in some overseas players' daily care) and ultimately the limited financial resources that supported such activities.

If we had the facility to support a rehabilitation specialist this would help us immensely with the foreign players who are used to this level of care and attention particularly during busy times when there are lots of matches and staff are all over the place. (Participant 4)

A wide range of skill sets within the team was also considered important in the current structure and with their tenure, an appreciation of team member skills was considered to have developed. However, despite discussion about the need for more staff, practitioners did not want the team to become too large. A member of the medical team referred to problems that could occur with current practices if the PHCT became too big:

...well you look at the staff at Man. City and Man. Utd, they are huge aren't they, they have got loads and loads of staff. If you said to me would I like that, the answer would be no. Because I think the interpersonal relationship, we have is really important and we are all really close and we all work really hard and we work together for an achievable end goal. I think when it becomes to big you lose that interaction, and you lose that interaction with the players as well and I have been at a big club so that's what happens. (Participant 7)

The participants' working offices were described as connected geographically and separated by a short walk (separate building) to the coaching staff,

supporting the culture of collaboration between individuals and departments. However, new training facilities were currently under construction and one practitioner felt that it would help the relationship with the coaching department:

It helps sports science and medical relationship because the two offices are interconnected. Especially for me because I'll have that side of my job, but I will also have the performance enhancement side of my job where I feel I need to be with the coaches a bit more. So, it hinders that relationship, so I am usually in and out of here. It doesn't help having outside corridors when it's raining.
(Participant 4)

The delivery of support to the players in the club was considered by the practitioners to be interdependent, requiring linked processes between staff. Examples of this include reference to both 'return to play' procedures and 'injury prevention' initiatives that involved multiple members of staff. This was identified under the theme 'teamwork reliant practice' as illustrated in table 13) The integration of a variety of professionals in these practices is highlighted by the following:

Our outcome is within the team structure. We are all going for the same thing, it's not one individual coming in and saying I am going to work on that and I'm going to focus on getting that right. They come in they work, they might have objectives with an ankle problem, but the masseurs are involved with the physios and then with the sports science staff, so we are working together as a group, it is not individual. (Participant 7)

At the end of the day we are all reliant and linked with each other so that we give players all our expertise combined, especially when they have big injuries and we need to get them back playing. (Participant 3)

There was also reference to the part-time members of staff who were considered to work more autonomously when compared to the full-time members. Practitioners referred to these staff as operating in a multidisciplinary mode in their interactions with the full-time staff:

I think we (referring to the full-time staff) do work as an interdisciplinary team, but we have multidisciplinary people coming in and out on a part time basis who work in isolation or in small groups and just provide us with their services.
(Participant 3)

Although the part-time staff were not involved in this study, reference to their work during the discussions revealed their contribution to the diversity of practitioners in the overall support team, despite making less contribution to meetings and team-led decision-making.

Contextual Competencies This concept encapsulates a requirement for practitioners to have variety of very specialist, context-specific skills to practice within the football environment. Discussions highlighted how each staff member needed to be compatible and complimentary to multiple perspectives, including relations with other staff members, players and dealing with performance stressors:

There have been physios here before who have been great physios but just haven't been able to cope with the football environment, that lack of routine,

maybe the whole environment, you have to be of a certain type of personality to deal with it..... so, I think it's hugely important. (Participant 3)

The importance of the 'person' and the interpersonal skills or non-technical social skills of each practitioner seemed to underpin the ability of the PHCT to effectively function within the football club. This is illustrated by the extract:

It's important your good at your job and its important you are well qualified but it's important how you are as a human being and how you interact and treat people. For me that's the key element of working in a football club. (Participant 7)

Contextual competency also refers to leadership as an important structural skill set of individuals within the PHCT. The acting leadership of the medical and sports science teams both emphasised their role in sharing information and subsequent decision making that resulted from meetings with the head coach:

Our structure is important. I think it is vitally important you have a clear lead and you have a line downwards so that everyone knows what their roles and objectives are and that's clear from us in how we work. (Participant 7)

So, we will have meetings with the head coach daily and come out of those meetings and like (**naming the other head of department) said, we will then have sub meetings say with my guys to say how the day is going to run and this is the plan, this is your area, can you do xyz. It just gets us all on the same page and gets it running efficiently really. (Participant 4)

The practitioners also discussed the provision of information to all members of the team through effective communication. This was considered to have been problematic in the past due to previous members of the PHCT having different ideas on how information should be shared. Information sharing was deemed to have systematically improved through daily team meetings at both the beginning and end of each day where possible to co-ordinate squad management.

Resource Workload Capacity The processes by which the practitioners were able to maximise the use of their resources as workload fluctuated throughout the season led to the development of this concept. This is reflected in the refined categories (table 13) e.g. 'distributed resource allocation'.

The demands placed on the PHCT during a Championship season were noted as stretching the resources of the PHCT in field notes taken by the lead researcher. These demands were recalled by practitioners who specifically referred to the number of matches played during the season and the challenge that the Championship league presented:

There is no doubt about it, the brutality of the Championship is a tough, tough division to stay focused for 46 games as well as the cup run is really difficult. (Participant 7)

If we have a Saturday-Tuesday game week, let's just say for the masseurs for instance, we would play on the Saturday, we would be in on the Sunday, they would be massaging the lads recovering, game prep on the Monday they would be massaging again, game on the Tuesday massaging again, Wednesday massaging again, probably off on the Thursday if we are lucky and then

travelling up north probably for a game and then Friday night they are working till half eleven at night. And that is constant for a 54-game season with the cup run which is tough, really tough, as we can go weeks without time off.
(Participant 7)

Linked to workload and resources, participants also spoke about the challenges of distributing the staff load between supporting the performance of the squad and managing injured players. This was especially an issue when matches were frequent, which they highlighted as significantly increasing their workload. There was also some discussion around how the clubs' facilities and staffing compared to other teams within the division, which they felt left them somewhat restricted.

The difficulty comes with resources when you have long term injuries. You have a focus for the short term the next game and you have got to turn your attention to the ones that have got injuries. They need sorting out and fixing and we have had 10 operations this year which has taken a huge amount of our time, visits to London, visits to other specialists, one went to Munich. (Participant 3)

I think for (**names the club) particularly, there is no beating around the bush, in the Championship, the resources that other teams have are far better and bigger than what we have got in terms of financial, facilities and staffing. So, there is a bit of a realization that for us to compete we need to sometimes think a little bit outside the box and be efficient. (Participant 4)

During the end of season review, a significant amount of discussion focussed on resource issues, which highlighted an ongoing desire for further investment into the facilities. This is highlighted by a quote taken from the focus group discussion:

We have just done an end of season review of how our season has gone concerning injuries and fitness and sport science and going forward.....we have forwarded that information to the chief executive and director of football to say that this is what we have done, this is where we are. The manager has had it as well. Does this help? Because above him, this is the top of our tree but above him is an owner and he might have to have a relationship with that owner in order to say this is what's going on, this is what has happened, can we improve it, and these are the improvements that have been recommended.
(Participant 7)

Practitioners spoke about the outcomes of their work being shared with the Board of the club, specifically data related to injuries and performance statistics. This data is published on the club's website as weekly updates. The following quote highlights how practitioners see this relationship as important:

We need support from the club, our results affect the profile and criticism or praise we receive. Ultimately, they employ us, and they are interested in our statistics for the club profile which affects our club brand, so we work together to be efficient because it's a business. (Participant 10)

One member of the team emphasised that the Director of Football was important to them in providing a link between themselves and the Board, as the data had an "impact on the football brand" and business side of the club.

Cohesiveness: This concept arose from a final theme, 'inter-personal relations,' that highlighted the importance of what was termed "emotional intelligence" and

the need to be a “good person” in discussions concerning working relationships. Despite describing the difficulties of working within the complex football environment, the PHCT spoke positively about their team and how they managed as a collective group. The football season was considered to be long in duration and staff reported sometimes working for weeks without any time away from their practice, given that both weekends and public holidays involve football fixtures. For these reasons it was considered important that all staff conducted themselves in ways that were supportive of others and facilitated the longevity of relationships. This is illustrated by the following short quote and reflected in the previous concept of interdependency:

It gets tough during the season, but we get through our differences and find ways to cope and work well together. (Participant 10)

The participants also referred to a need to have “positive attitudes” within the PHCT, given the context of the football environment which was considered to put staff under a lot of stress. The practitioners suggested it had implications for their work if the wrong people were involved:

It sought of verifies what (**names another staff member) said about that the team composition because if you are a good physio. but you are not a good person, it's just not going to work. That's why it is successful from our point of view because we are all good people. (Participant 7)

The participants also referred to how they dealt with differences of opinion in practice, highlighting their ability to “speak with each other freely” and discuss different views on how things might be achieved moving forward from concerns over practice:

We try and look after each other and back each other, so for instance if there is something we don't agree as a physio team that sport science are doing, we don't criticise them but what we might say less formally is 'we are not sure about that, what do you think?.....We back each other to the core publicly and discuss things openly after. (Participant 7)

Cohesiveness is also linked with the concept of ‘structured inter-professional practice’ and a precursor category ‘evolving collaborative practice’ (table 19). This emerged from references to increasing collaboration between staff and practice arrangements over the time that they had been working together in football:

It's my third season in football and second with the staff, what I am starting to see is things coming closer together and the team members becoming one really. (Participant 1)

The emergence of this concept also reflects field notes that described the harmonious nature and agreeableness that the discussions tended towards during the focus group. This was noted particularly when the staff referred to the need for collaboration.

Inter-professional Decision Making This concept emerged from the theme ‘performance health judgements’ and the discussions which led to two precursor categories, ‘shared the decision making’ and ‘informing decisions,’ that formed part of the processes discussed by practitioners. The practitioners

recalled the process by which they provided their expertise to inform decisions made by the head coach. Their emphasis suggested that they had varying degrees of influence each day on the final decisions regarding certain areas of practice.

The guy that makes the final decision on how he wants to operate is the head coach based on the information we are giving him. (Participant 4)

(**names of colleagues) have touched on it in that we have that information available and give it to the head coach. It is whether that head coach chooses to take that on board, adapt it or listen to our suggestions so that you have that consideration. We don't always get our way and he has the final say even on significant parts of our work. (Participant 3)

The negotiation between the PHCT and the coaching department was noted as an emotive topic in the field notes. Decisions related to training loads and load management were particularly emphasised:

Every week in the management meeting with the coaching staff, me and (**names his colleague) will end up discussing or arguing about the load that is going through the team, don't we? (Participant 7)

Particularly if it comes back to the emotion and we have lost, the coaching staff will often feel we need to put more work into them or we conceded two at set pieces so they feel they need to do longer work on set pieces in the next training session or players don't look sharp so they want to do more small-sided games with them. Whereas I might be arguing well they are not sharp because they are fatigued so give them more recovery to get that back so that is the challenge for me. (Participant 4)

The following extract illustrates the frustration that a member of staff had because the advised recovery protocols between matches were not always adhered to due to decisions made against the PHCT's advice.

The biggest challenge and frustration for me is in between the games making sure we don't train too long down there. Because for everything that we do, it can be undone by them over training before the next game. You are trying to get them back to their freshness to go again but if we are doing a little bit too much at times which the coaching staff have been guilty of despite our advice, then you are not going to have that back regardless of what we do. (Participant 4)

A similar pattern emerged regarding the PHCT's monthly planning, where although a plan would be signed off by the head coach, it was often subject to change. This frustrated the PHCT, who were required to work on days previously scheduled as days off and could be recognised as an organisational stressor given the wider problems this was reported to cause for practitioners' private lives (e.g. family commitments). This problem was exacerbated when the club had unfavourable results, where the practitioners reported that additional days of work were often required to support the extra days training that players were required to participate in to improve their results.

PH Management Outcomes: This concept emerged from two final themes 'squad management outcomes' and 'evaluated teamwork effectiveness'. Both themes resulted from discussions surrounding the outcomes of the PHCT's

processes and as well as how the team's performance was assessed. PA was considered fundamentally important to the work of the PHCT but required a balance with professional responsibilities and a duty of care for players:

That is our job isn't it, to make the most number of players available for the manager at any moment in time, that is what we are all trying to achieve.....and player welfare I think is important as well when thinking about availability. I think on the medical side we are a bit more like, we are trying to look after the player. The player's emotional and mental issues that they might have or whatever as well as their physical side to then make them available. (Participant 3)

There was also discussion about the successes of their work, reflected in the club's on-field results in the last few seasons. The practitioners referred to the on-field achievements exceeding what was expected in major competitions particularly during this study. At the same time there was mention of an unprecedented number of injuries where players needed which combined with the accomplishment of returning all these players to competition.

The team outside of this team has been successful, semi-final of the Caribou Cup and 10th in the league represents a good finish for us, 17th last year so. That's where we are judged ultimately.....We have had 10 operations as I said earlier, so to get 10 players back on the football field now without problems is really great considering the problems we have had thrown at us. It's been very difficult, but we have dealt with them. (Participant 7)

Practitioners referred to associations between competition results and their off-field work as contributory to their tenure in employment at the club. This was made with reference to the collective accountability of their work within the club:

In this unforgiving results environment, we need to work closely together, our successes or failures affect us all, we can't take our jobs for granted. Failure as you know can result in it all being over in no time whatsoever. (Participant 7)

The practitioners all considered evaluation and reflection of their collaborative work to be important with regards to 'professional development' and improving support services to the players. However, the procedures for this were not formalised, as reflected in the following extracts:

I think we do that on a retrospective basis, we look back and say right, say for this player who has had a lot of groin and hip issues what could we have done, would we have done something different and we kind of go through it and look back it retrospectively. We might have changed that or no we think we have done ok there. I think it's important for your professional development to always be questioning yourself and is that the right thing we have done, could we have done something different. (Participant 3)

You have to reflect though on what you've done in football because we all learn from our experiences and one thing I got told is always reflect and review what you have done because when you are 10 years in you might on paper have 10yrs experience whereas in reality you might only have 1 year of experience 10 times if you keep doing the same thing. (Participant 4)

Moreover, practitioners spoke about continuous evaluation using key performance indicators that were completed at request of the football club.

We don't sit down and say right (***)named a colleague) you write down everything I can do better next year and vice-versa (colleague interrupts). You do those KPI's though, which we use to set goals and we all try to meet on a monthly basis based on what is happening. (Participant 7)

One practitioner highlighted that reflection on the team's collaborations over the past few years had resulted in improvements in their practice and results on the field of play. This was considered possible because most of the team had been together for a few years:

I think that shows because we have been innovative by looking backward first. We have been here four or five years and have gone from 12th in league one to first in League one to 17th and now 11th. So, there has been a progression every year. (Participant 4)

The practitioners also described how they were receiving support for innovation from the club through the building of new offices that they themselves had been involved in the design of, as well as the significant investment in a recovery from competition facility, which took the form of a mobile cryotherapy unit stationed in the training ground. This formed the basis of considerable discussion during the end season review.

End Season Review (From Field Notes)

The end season review meeting addressed several elements relevant to this study, including discussions relating to injury, training/competition loads, return to play and inappropriate player access to consultants to support their performance and health through the football season. Much of the deliberation focussed on how processes could be improved in preparation for next season.

Injuries/Training Load and Competition The higher number of injuries experienced during the season was discussed as unprecedented, which were reported as representing a 25% increase on the previous season (although this was not measured in this study). The medical staff highlighted that they considered this to have been most problematic during preseason as well as between November and January. These peak rates of injury also coincided with the highest training and match loads according to their calculations. There was strong suggestion from the medical team that the success in the cup competition, and the subsequent increased number and demands of each match (particularly against Premiership opposition), were a causative factor in the higher injury rates.

The medical and sports science team had planned to host a conference for coaching, sports science and medical staff some weeks after the season. The PHCT suggested that the coaching team as well as other attendees should be part of a discussion around training load, particularly during busy fixture schedules. The PHCT were of the view that this could provide a good forum for the viewpoints of the coaching staff to be shared with a wider audience such that ideas that emerged, might foster better future practices in-season.

Use of External Consultants Six players were reported to have used service providers to support performance or health matters outside of the football club's

guidance. This was noted as a concern for medical insurance, contractual issues, performance, players' welfare and general education. The overriding concern expressed by the PHCT was that they felt some advice being received was from practitioners not vetted by the club and not suitably qualified, meaning that at times, contradictory treatments/programs to that which they would prescribe had been followed. As the PHCT were not being included in this process, the balance between what is contractually obligatory (i.e. all medical treatment of players for football matters should be under the guidance of the football club medical staff) and what the players felt they wanted to do, had created particular issues during the season.

Return to Play Pressures to return players quicker than the PHCT would have liked due to the demands for continued success meant that some procedures had been circumvented during the cup competition. Collectively the PHCT had considerable concern that the pressures to return players quickly were responsible for processes being disrupted. In some instances, disruptions to processes were considered to have resulted in re-occurrence of certain injuries.

The return-to-play system involved several practitioners taking players through 'checkpoints' to ensure their suitability to return to training and/or competition, and it was felt that the latter stages were curtailed by coaching decisions. The PHCT wanted the club to have a written policy that involved documented recorded activity to avoid the pressures that take hold during the competitive season and to avoid putting the players' wellbeing at risk.

Chapter 5 Discussion and Conclusions

5.1 PHCT Processes and Player Availability during Match Congestion

This study used an adapted ITEM as a framework to guide an investigation into potential relationships between a PHCT's structures, processes and outcomes. The individual practitioners that composed the PHCT identified themselves and were seen by other departments within the club (directors, media and players), as a team and professional grouping. The PHCT, through their heads of departments, also managed relationships across other departments within the football club including regular contact with the financial and logistics teams. The PHCT can therefore be considered to meet the ITEM's widely accepted definition of a 'team' outlined by Cohen and Bailey, (1997). The novel interpretation that the *multi-disciplinary* PHCT in this study could be investigated using a teamwork model (ITEM) was consistent with the use of teamwork models across a range of studies; however, this is the first to do so in football.

The survey tool employed to assess the PHCT processes (part 1) during 'team meetings' was based on the premise that the practitioner's perceptions of the quality of team meetings would be related to the interactions between the PHCT staff (Roelofsen et al., 2001). This was the case, with a strong correlation between the PHCT's satisfaction regarding the discussion process in meetings and the extent to which team members behaved negatively towards each other ($r = -0.73$, $P < 0.001$). Not surprisingly, this suggests that practitioners are more satisfied with meeting processes when there is limited negative behaviour between them. For the purpose of this study these findings confirm the ability of the questionnaire to assess interaction patterns in a football setting as has previously been demonstrated in organisational teamwork research (Roelofsen et al., 2001)

Consistent with the findings from match congestion research (Dellal et al., 2015; Dupont et al., 2010), match frequency was strongly associated with player availability in this study. Match congested stages of the season were associated with fewer players being available for match selection which could be the result of a higher numbers of injuries that typically accrue when the recovery time between matches is restricted to ≤ 3 days (Bengtsson et al., 2013). Match congestion in this study presented a significant challenge for both players and the PHCT in their performance and health management practices. The relationship between match frequency and player availability deserves consideration of several football related factors. During match congested phases of the season the PHCT would have continued to implement injury prevention activities as was evident in their reported prioritised practices. Evidence suggests that in many instances these practices alone may not be able to prevent a significant spike in injuries during such periods of intense competition (Carling et al., 2013b; Nedelec et al., 2012). This may be a result of player compliance with PHCT injury prevention programmes, which has been shown to vary quite considerably in football (McCall et al., 2016). Similarly, coach compliance with PHCT initiated programmes has been shown to be sub-

optimal across European clubs (Arkenhead and Nassis, 2016). The qualitative aspects of this study also support the notion that coach compliance was also not consistently favourable in this study. Practitioners reported that the head coach had final say on significant aspects of their work, particularly when competition results were not favourable. This resulted in the application of alternative strategies to those proposed by the PHCT e.g. coach led adjustments to the training load prescription. These findings are consistent with the perceptions of practitioners across European football clubs who report that coach interventions can negatively impact the effectiveness of their work (Arkenhead and Nassis, 2016). These football related factors are likely to have impacted the relationships between team processes, match frequency and player availability. Future studies should investigate the views, roles and relationships that the coaching processes have with both the PHCT's work and PA, to further illuminate these considerations. Nonetheless, match frequency remains strongly associated with the number of players available for match selection, as is evident across much of the match congestion research (Bengtsson et al, 2013; Carling et al., 2016; Dellal et al., 2015).

The type of interaction between PHCT practitioners, represented in this study by the 'teamwork approach' and their underlying team processes, was strongly associated with PA. Although correlations do not indicate causation, the results suggest that variations between multidisciplinary and interdisciplinary teamwork practices are associated with the number of players available for competition. The link between team meetings and PA may therefore be related to the quality of interaction between PHCT members, decisions that emerge from the discussions (result satisfaction) and the appropriateness of the content and effectiveness of subsequent delivery to the players, although this was not determined in the study. Consequently, there are likely several reasons for the observed relationship between teamwork approach and PA over the varying match frequencies. For instance; longer periods of time between competition would have allowed the PHCT more time to administer their work effectively and, under less stressful conditions typically experienced during frequent competition. Similarly, with less regular competition, players have more time to recover from matches physically (Nedelec et al., 2013a) and mentally (Laux et al., 2015). Whilst there is a lower risk of injury during frequent competition (Dellal et al., 2015) the PHCT must guide appropriate training loads in preparation for the next bout of competition and failure to do so has been associated with a spike in injuries during these phases (Doeven et al., 2017).

Although the 'teamwork approach' scores in this study cannot distinguish categorically between interdisciplinary and multidisciplinary approaches for any given time points, the seasonal variation in teamwork scores indicate that, the PHCT meetings operated on a continuum between the two, with increasing scores favouring the interdisciplinary end of this spectrum. No statistically significant relationship was found between 'teamwork approach' (team process survey part one) and match frequency; however, the lowest 'teamwork approach' scores (multidisciplinary behaviours) were typically found during congested match periods when there was less time for practitioners to conduct

their work or interact at meetings. When the PHCT adopted an interdisciplinary approach, practitioners participated more and were happier with both the process and results from meetings, they also reported lower levels of negativity towards each other. It would seem that that the PHCT practitioners made best use of their knowledge and expertise during interdisciplinary team meetings, accounting in part for the positive relationship with PA. This is consistent with the conclusions drawn from the body of research that has focussed on interdisciplinary as opposed to multi-disciplinary approaches to teamwork behaviours in healthcare and other organisational studies (Mirjam, 2010; Xyrichis and Lowton, 2008), including productivity in manufacturing industries (Jaca et al., 2013). These findings are also in accordance with the conclusions drawn within editorials focussed on Olympic sports (Dijkstra et al., 2014, Dijkstra et al., 2016) and football (Ekstrand et al., 2013), which have suggested that communication and collaboration which embodies an interdisciplinary team approach, to have positive implications for PH. This is exemplified by UEFA's medical research group that have positioned 'communication' between support staff as a risk factor for injury (Ekstrand et al., 2013). However, the present study would be the first to use both quantitative and subsequent qualitative data to establish a link between team processes including communication, collaboration and the performance health of football players. This is a significant knowledge gain at a systems level as opposed to the considerable volumes of research already conducted at a player level.

Previously unreported in the literature, this study suggests that match congestion can result in more autonomous teamwork processes when compared with periods outside of match congestion as reported by the PHCT practitioners. The relationship between teamwork approach and PA is also indicative of reduced communication and collaboration concomitant with a multidisciplinary approach during the match congested periods. This is exemplified in the sport literature that has described multidisciplinary teamwork approaches under a 'reductionist model' (Dijkstra et al., 2014) which is associated with limited or reduced levels of communication and partial integration/collaboration between practitioner disciplines (Shay and Lafata, 2015; Dijkstra et al., 2016). Consequently, practitioners are likely to engage in less shared decision-making given that it relies on closer interactions between them.

Shared decision-making in *multi-disciplinary* teams working under pressure has also been shown to conflate individual practitioners into making decisions only within their own scope of practice in healthcare (Nancarrow et al., 2013). The relationship between teamwork approach and PA during match congestion could therefore represent practitioners working along disciplinary lines with limited interdependent practices which typically ensure the full benefits of the team's collective ability and intelligence (Mayo and Woolley, 2016).

An interdisciplinary approach to meetings embodies the notion that PHCT practitioners are contributing to collaborations that underpin shared performance health judgements. For these reasons, it is possible that the range

of diverse skills within the PHCT were most effective outside of match congested periods, due to higher levels of collaboration, communication and shared decision-making. In the context of football, it had previously not been reported that the teamwork approach adopted by a PHCT is uniquely associated with player availability. This represents a significant outcome for the potential performance of players and the ambitions and economic performance of football clubs, because higher PA increases the chances of team success (Ekstrand, 1983; Eirale et al., 2013). The implications of these findings are that interdisciplinary behaviours within the PHCT should be a strategic priority for the football club, particularly during match congested periods.

Several mediators of teamwork effectiveness were clearly important to PA in this study. The PHCT were largely satisfied with the process of discussions in meetings, the solutions that emerged from those meetings, and their individual participation over the course of the season as demonstrated by the median response scores for these domains. Further, the importance of these processes is demonstrated by strong associations found in this study between 'negative interactions', 'result satisfaction' and player availability. Team processes, including interaction patterns, have been shown to be related to teamwork performance (Nancarrow et al., 2013; Landry and Erwin, 2015) and in this study they were assessed in team meetings which acted as an important juncture and for PHCT work.

The number of meetings that PHCT members had during the season, and the level of satisfaction with the outcomes of those meetings, were most importantly associated with PA. In fact, the more PHCT meetings conducted during the season, the higher the number of players that were available for match selection. Practitioners were also asked to rate their confidence, commitment, contribution and responsibility for the plans that emerged from meetings (results satisfaction), where higher ratings were associated with higher PA for match selection. Practitioners also reported the importance of attendance at meetings, suggesting that their active contributions are integral to their subsequent satisfaction and the actions that follow to support player availability. The need to leave meetings satisfied and with a sense of involvement in the process has also been demonstrated across healthcare research focussed on team processes (Bateman, Wilson and Bingham, 2002; Algozzine et al., 2016). Communication is central to all team processes as a non-technical skill that supports teamwork effectiveness (Sargeant et al., 2008) and in this study the team meetings provided an extremely important space for this to occur.

Team auditing/evaluation conducted during team meetings yielded relatively low median scores when compared to other team process domains; however, it was positively associated with the number of players available for competition and more frequently conducted when there was more time between matches (higher match frequencies). Despite this indication of a limited usage of audit and evaluation within PHCT meetings (most evident during match congestion), its power to improve team functioning, and particularly learning through feedback, have been considered central to teamwork effectiveness (Xyrichis and Lowton,

2008). Although the degree of complexity involved in the audit and evaluation conducted by the PHCT was not considered in this study, evidence suggests that the more sophisticated it is, the greater the benefits to the outcomes of multi-disciplinary teamwork (West, 2002). The PHCT should further prioritise this important mediator within team meetings most particularly during match congestion, such that it could further contribute to their PH objectives that ultimately improve PA. The ITEM is not a definitive model and was not intended as such (Lemieux Charles and McGuire, 2006), and the addition of auditing/evaluation to its framework, demonstrates that within a football context there can be additional processes worthy of consideration.

Maintaining the PHCT's ability to review past work and decide upon subsequent priorities through effective communication is important especially during match congestion. The results in this study indicate that match frequency may have had a detrimental impact on player availability in part through its disruption to team processes that occurred within meetings. This would suggest that communication outside of the formal meeting space would be an important contributor to the teamwork processes. During match congestion, practitioners reported that they had less time for interaction with each other and were forced to work more independently. However, no relationship was found in this study between informal and mutual exchanges outside of meetings and PA, which is contrary to research that suggests that communication outside of meetings can account for up to one third of the variance in multi-disciplinary team performance (Pentland, 2012). Pentland's research aggregated results across a large variety of teams including short term project teams and large industrial groups, clearly representing a different context to football nevertheless, this may present a limitation to the current study given the small amount of data gathered pertaining to informal communication outside of the context of team meetings. The PHCT spent long working weeks (including weekends) together, during which time there would presumably be ample time for informal communications outside of meetings; however, given the demands of competition which also involved travel, the PHCT was also split across a variety of locations. Therefore, different types of communication may have occurred that were not captured in this study. Future research should consider the wider aspects of communication that exist outside of meetings including mapping (frequency and time points of contacts between individuals) and engagement (how team members engage with one another) that have been found to impact the outcomes of multi-disciplinary teamwork (Pentland, 2012). New forms of communication could then be incorporated into the ITEM as team processes. This would provide deeper insight to communication outside of meetings and further an understanding of team process relationships with teamwork effectiveness.

Xyrichis and Lowton (2008), in their review of teamwork in healthcare subsequent to the publication of ITEM, considered team meetings as a teamwork factor and mediator of the relationship between a team's structure and the outcomes of its work. Team meetings in this study proved to be an important juncture in the performance and health (PH) management of football players, which is also consistent with findings in health-related practice where

the team meeting plays a similar role in the patient care pathway. Such meetings facilitate the review of prior work and planning of future work between *multi-disciplinary* practitioners (Kane and Luz, 2011). Previously unreported in the football context, the interdisciplinary team meeting and their frequency should be prioritised in the practice arrangements of PHCTs should the results of this study be transferrable to similar clubs. Future research might also consider how to improve each team meeting, as has proven useful in other healthcare settings (Wiles and Robison, 1994).

Team processes are clearly associated with the number of players available for competition but presumably team processes would also be related to match frequency. No strong relationships were found between team processes and match frequency in this study, which is surprising because, when there are longer time periods between matches, practitioners have more time to plan and administer their programs and engage more fully in team meetings. To detect potential variance attributable to the influence of match frequency on team processes may require a larger sample than the current study presents and the subsequent use of statistical techniques with more power.

5.11 Team Structure and Teamwork Effectiveness

The structures revealed during this study as defined by ITEM included six professions broadly divided into sports science, medicine and data analytics, with all staff reporting to the head of sports medicine or science. Additional specialists were involved in PH management albeit on a part-time basis. These specialists typically provided services when requested to do so (e.g. reflexologist, chiropractor and podiatrist). The full-time practitioners reported that these staff worked independently and did not attend formal meetings. The views of part-time staff have limited representation in the present works and may not reflect those of the full-time staff, and this can be considered a limitation of the present study. However, these staff did attend the end-season review meeting. The diversity of practitioners involved in the PH management of the football squad therefore consisted of members from very different backgrounds which in football has been highly regarded by the players as an important contributor to their performance and health (Pain and Harwood, 2007). The structure of *multi-disciplinary* teams is deemed an important factor contributing to teamwork effectiveness across a range of healthcare and organisational studies research using the framework of teamwork models (Bower et al., 2003; Xyrichis and Lowton, 2008). The present study is the first to use the framework of the ITEM to illustrate the structure of a PHCT and its contribution to a deeper understanding of relationships between team processes and PA. The PHCT reported a number of teamwork factors or “team inputs” as illustrated with ITEM, that are representative of their “task type and features”, “team composition”, and the “organisational context” under multiple dimensions of their structure as has previously been demonstrated using the ITEM in non-sporting domains (Anneke et al., 2016; Lemieux-Charles and McGuire, 2006).

The PHCT reported their task type as specifically focussed on the management and delivery of performance and health, including prioritised practices for monitoring training and match loads, recovery routines/programmes, and the treatment and prevention of injuries. These activities are consistent with practices prioritised across a range of elite teams in Europe (McCall et al., 2014; McCall et al., 2015) and major league clubs around world (Akenhead and Nassis, 2016). The emergence of these similarities occurred despite the PHCT's requirement to manage a squad through more domestic league games during the investigated season, than any other PHCT is required to in other leagues across Europe. The modern demands of the English Championship, seem to shape practitioner work toward a commonality of practice where, like in the Premiership league, there is a requirements to focus all efforts towards the demands of the next match, despite staff wishing to take a longer term view (Gilmore et al., 2018). Having structures that are only focussed on shorter term aims, may in part account for the 'unprecedented number of injuries' and multiple medical operations reported by practitioners in the present study. Similarly, evidence of a rising incidence of muscle injuries over 15 seasons reported across European clubs (Ekstrand et al., 2013; Ekstrand, Waldén and Hägglund, 2016) may also in part, be attributable to similar conditions prevailing outside of the present study. Considering that practitioner and coaching staff's performance, may be increasingly measured by competition results (Panagiotis and Konstantinos, 2018) these priorities in practice might not be considered surprising given their implications for the economic and financial aspects in each club. This is also reflected in the ongoing UEFA Elite football injury study across European clubs, which has highlighted that the key to football medicine is keeping players on the pitch to support competition (Ekstrand, 2013a).

Practitioners in the present study reported the demands of match frequency, the need to quickly return players from injuries and decisions taken by the head coach, as a driver of their focus on shorter term objectives i.e. optimising PA for the next bout of competition. Notwithstanding the demands of football environment in this study, the PHCT had the professional responsibility to protect both the short and long-term health of the players, however this clearly can require balancing against the potentially competing demands of the head coach whose priorities are considered focussed on winning (Ashton, 2016). The need to win competition is inherently the driving force behind the work of the practitioners in this study and their strategic choice of actions to support the coaching team with whom they work. When fewer players are available for competition due to injury/illness, coaches must presumably select players with lower technical proficiency and thereby reducing potential team performance (Windt et al., 2018), although the mechanisms by which this affects match play have not been investigated. With the PHCT's task type in the present study (representing a structural team factor as defined by ITEM), considerably focussed on PA for the next and upcoming competition, these works demonstrate the importance of team structure to the ambitions of the support team. What is clear from the present study, is that the PHCT is structured and has processes to support a result driven environment, existing proximally to the coaching team with which they must work to support club level success.

Head coaches will play a significant role in dictating the “culture” within the football club (Arnold et al., 2012) as well as their leadership style having the potential to impact injury rates and PA (Ekstrand et al., 2017). The most effective performance health management will in part be dictated by the relationship and understanding between the head coach and the PHCT (Arkenhead And Nassis, 2016) and the findings in this study support this. Future research should consider this relationship more deeply, given that these considerations of the football environment have such an important impact of the performance and health of players in this sport.

PHCT practitioners viewed their task features to be largely interdependent as opposed to autonomous, with 80% of staff considering their teamwork approach to be interdisciplinary as opposed to multidisciplinary. Defined as a ‘task feature’, this ‘interdependency’ provides a link between the PHCT’s structure and processes as illustrated by ITEM (Lemieux-Charles and McGuire, 2006). Both in this study and within healthcare research (Bower et al., 2003), interdependency within teams has been shown to be commensurate with higher levels of communication and collaboration. In the present study, this was reflected in the higher teamwork approach scores during periods outside of match congestion however, during match congestion practitioners interacted with lower levels on interdependency instead operating in a multi-disciplinary manner.

The composition and attributes of PHCT practitioners, as well as their disciplines, play an important role in team processes, collaboration and communication. This was supported by practitioners reporting the importance of working with team members who have good interpersonal skills and a good understanding the football environment. Emerging as a theme and conceptualised as a ‘structured interdependency,’ this study illuminates the need for PHCT members to be capable and willing to work across disciplinary lines and to avoid conflating to only their own disciplinary considerations, which can have negative implications for teamwork effectiveness (Landry and Erwin, 2015). This clear link between the PHCT’s structure (staff diversity of skills and interdependency as defined by ITEM) and team processes (collaboration and communication) provides a novel link between these important contributors to teamwork effectiveness in the football context.

A ‘structured interdependency’ was conceptualised in the present study to represent practitioners’ reliance on collectively fulfilling a number of roles within the club. This is consistent with its classification as an important structure within effective teams in previous research (Lemieux-Charles and McGuire, 2006). Contributing to the PHCT’s structure as defined by ITEM, it could also be seen as an ‘emergent state’, due to its development over the tenure of the team. The development of interdependency between practitioners within the PHCT may have played an important role in their ability to manage the extremely long hours required in their roles, the stressful nature of the work, and the social needs of their multi-disciplinary team, as has been demonstrated to be important in other highly pressured working environments in healthcare (Kozlowski and Ilgen, 2008). This is supported by practitioner reference to a need to ‘support and consistently back each other’ and the need to be ‘a good

person' in within the team. The PHCT collectiveness should have also contributed to having a much greater influence in negotiation with the coaching staff, such that final decisions were more likely to align with their shared performance health judgements in negotiation with the head coach. However, during difficult periods e.g. when results in competition were not favourable, this was not consistent. Nevertheless, the PHCT's collectiveness would have been important over the course of a long, arduous season which the practitioners described as full of 'emotional swings' that required the team to have a solid structure to endure.

The challenges that confront the PHCT were elevated during match congestion and coincided with them having less control over factors that challenge health (e.g. competition load). Periods of match congestion present the PHCT with some players within the squad requiring a specific training stimulus to improve potential performance whilst others need significant recovery, all within a limited time frame. This common situation is an important time for PHCT members to know and understand their roles clearly, and the structure of their team becomes important if they are to maintain collective and co-ordinated practices. Structure is highlighted because ITEM recognises working in isolation as a structural choice which can increase the risk of injury to players through training load errors or inefficient communication leaving teams in what has been described as the 'Bermuda Triangle' (Gabbett et al., 2016). Teamwork errors are typically related to communication failures, and this has been reported in several high-pressured environments including accident and emergency departments in healthcare (Amour et al, 2005; Classen et al., 2011). Interestingly, the practitioners in the present study did not see changes in practice during match congestion as structural changes, but instead adjustments to their work cycle in response to the prevailing demands and stresses arising from varied match frequencies. With the PHCT working more autonomously and with perceived limited resources, the chances of teamwork errors resulting in inappropriate performance and health judgements would have been elevated because of less interaction and less shared decision-making during meetings. Errors may therefore have contributed to the relationship found between teamwork approach and PA, given that practitioners reported an 'unprecedented number of injuries' during the season; however, this was not objectively measured in the study. Nevertheless, multidisciplinary approaches to working with colleagues is not favourable to PA during match congestion, where structural considerations are clearly implicated.

With 10 full time members actively involved in various PH activities, the study participants perceived that they required more staff resources to better manage the performance health of the football squad, particularly during congested periods of the season. This has also been a consistent theme within many elite clubs across Europe, where practitioners report their effectiveness as a team to be sup-optimal echoing similar concerns (Arkenhead and Nassis, 2016). Resources, including the diversity and size of teams, are key structural elements (Lemieux-Charles and McGuire 2006; Patrashkova-Volzdoska et al.,

2003; Xyrichis and Lowton, 2008) that also play an important role in optimal functioning of multi-disciplinary teams (Kozlowski and Ilgen, 2006). Yet, the literature also suggests that there may be a curvilinear relationship between team size and effectiveness (Patrashkova-Volzdoska et al., 2003; Cohen and Bailey, 1997). It is therefore not clear whether recruiting more staff would impact the motivation, behaviour and processes of the PHCT positively, given that larger teams have been found to have differing dynamics and sometimes lowered teamwork effectiveness (Miklavcic et al., 2007).

The PHCT managed the team to the latter stages of a cup competition, which meant playing matches against higher quality Premier league opposition and exacerbation of an already congested match schedule. When teams advance to latter stages of tournaments, the level of competition increases and the ability to recover becomes more important for success (Bengtsson et al., 2013b). Recovery practices during match congestion would have been extremely important duties performed by the PHCT, who described these periods in the season as stressful. Team members were reported to be thinly spread across different locations and having to work for weeks without a break from the demands of the squad. High levels of stress in football support staff have been reported to negatively affect their working performance (Arnold et al., 2017). It is possible that, during demanding times in the season, the PHCT will not be able to effectively mobilise their energy and skills for favourable task engagement, as has been demonstrated to be an issue for a variety of athletes (Hanin, 2007) and practitioners (Arnold et al., 2017) working under pressure in sport. Teamworking effectiveness relies on team members working optimally and, should this not be the case during match congestion, inappropriate performance health judgements may be less than optimal with potential negative implications for PA. Finding ways to help support team practitioners during stressful periods in their organisational performance has been highlighted as worthy of both practical and further research attention in high pressured elite sport (Arnold et al., 2017).

The practitioners considered their working tenure (team composition within ITEM) as contributing to their ability to work together as a group and hence understanding of each other's roles and collaborative practices. Team consciousness of both their diversity and specialist skillsets could be considered an "emergent state" that is the foundation for the ongoing refinement of their teamwork processes. Although not previously described as such in previous teamwork studies, the awareness of other's roles and improved collaboration that were reported to develop from such an understanding, has been shown to contribute to teamwork effectiveness in Olympic sports (Arnold et al., 2015) and in healthcare settings (Haward, 2003; Mirjam, 2010). Cross-disciplinary appreciation is an important team attribute, as it has been linked with team processes (e.g. communication, collaboration, empathy) that contribute to teamwork effectiveness through a better understanding of common ground and participation in shared decision-making (Xyrichis and Lowton, 2008). In the context of football, this novel finding that specifically focusses on a PHCTs development through tenure, reflects its inclusion within ITEM as a teamwork structural factor that in the present study provides evidence of a link between PHCT structure and processes.

The ITEM describes the contribution of specialist knowledge to team effectiveness in healthcare through task features. The PHCT perceived that over 80% of their daily tasks required specialist skills that they considered to be significantly integrated into the support team's collective work. This is also reflected in the range of categories that emerged from practitioner views of the roles they played in PA decisions. These included data management and analytics, risk assessments and reporting recovery kinetics post-competition. The job titles that many of the practitioners registered in this study did not wholly reflect the range of roles in which they were involved. This is consistent with other research which indicates that the duties performed by support staff in football are widely varying (Arkenhead and Nassis, 2016). Despite a wide array of specialist professions and their corresponding disciplinary knowledge that composed the PHCTs in football, this study illustrates an overlapping of roles commensurate with interdisciplinary practices seen in healthcare and organisational studies (Nancarrow et al., 2013). The football players in this study were managed holistically by the PHCT, which is consistent with a view that no single practitioner is able to meet the increasingly complex needs of contemporary players (Strudwick, 2013). This follows a similar trend that has been recognised in healthcare research, where interdisciplinary teams working across traditional professional boundaries have been shown to be the most effective in managing complex patient needs (Mirjam, 2010; Nancarrow et al., 2013; White et al., 2013). The collaboration between PHCT members would suggest that the welfare of players was being fully addressed using all of the skills within the PHCT. However, during match congested periods this would have been somewhat compromised by the adoption of multi-disciplinary practices.

Much of the research focussed on team learning and growth has concluded that innovation and change within *multi-disciplinary* teams is intrinsically linked to the organisational context and, external support received from their management (Borrill et al., 2000). The practitioners all stated that they were in receipt of a continuing professional development budget; however, they rated their support for innovation and change at ~65%, suggesting that there were areas of support not fully satisfying their needs. The team had been involved in collaborative longer-term planning with the board of directors for improved training facilities and larger PHCT premises, but when asked to what extent they had received support externally, on average they responded 'to some extent' on the rating scales. External support has been shown to be related to the quality of teamwork in healthcare and a strong predictor of teamwork effectiveness (Xyrichis and Lowton 2008). Despite the length of tenure that the PHCT had already accrued working within the club, the longer-term perception of being supported by the organisation in which they work may prove important to the sustained levels of teamwork and commitment to the organisation as a whole. This has been demonstrated to be important in other highly pressured environments including accident and emergency departments and operating theatres, where longer serving members feel they are well supported by their organisations (Amour et al., 2005; Bower et al., 2003). The close geography of the team premises reported in this study supported practitioners' ability to quickly and easily communicate with each other through face to face contact, but they were apart from coaching staff who had offices in

the next building. Similarly, medical treatment and training facilities were on site and within walking distances from these office spaces, supporting perceptions that practitioners worked in very close proximity to one another. However, the sport science and analysis practitioners reported having to regularly move between their own office and the coaching offices to communicate information. This was expressed as undesirable in that it separated them physically, socially and psychologically from this group, where they considered most of the final decisions were being made on factors related to their work. Teamwork research suggests that professionals need to be able to share their views and perceive themselves to be part of decision-making processes, particularly in stressful working environments (Richter et al., 2011). In this instance, the PHCT structural arrangements as they relate to team premises, were perceived to negatively impact communication, which, could have been detrimental to PA through less effective communication and participation in decision-making (Molyneux, 2001; Wiles and Robinson, 1994).

This study's novel approach in using the ITEM has illustrated a deeper understanding of the structural arrangements and task design of a PHCT. Within the context of the English Championship league, the teamwork model has provided a deeper understanding of structural working arrangements during varied match frequencies than has previously been provided in the literature.

5.12 Implications of Team Structure on Player Availability: Explanatory Accounts.

The ITEM has provided a framework for illustrating how a PHCT's structure can be linked with both its processes and outcomes (i.e. player availability) as originally conceptualised (Ilgen et al., 2005; Lemieux-Charles and McGuire, 2006; Jaca et al., 2013). The structures that the PHCT adopted during the football season were linked to processes that emerged during team meetings, with implications for the number of players available for competition. These structures also facilitated a better understanding of relationships between processes and PA, particularly during match congestion. The structure of the PHCT can only be translated into optimised PA if team processes are effective. During match congestion, given the requirement to manage a squad of players, a significant flow of information between staff, players and coaches will be required in order to standardise work and maximise the efficiency of activities focussed on PH. How well this information flows has consistently been shown to be a defining feature in successful teams (Erhardt, 2014). Non-technical skills are therefore important; however, they require appropriate structures to support efficient functioning and to reduce the likelihood of errors in performance health judgements made by the PHCT. The ITEM depicts a PHCT's structure to be a system of co-ordinated tasks that, through various processes, directs the achievement of performance and health goals. PHCT members reported team premise issues which were considered to restrict consistent communication and ability to impact decision-making in association with them. Psychological, social and organisational aspects related to these structural issues emerge, which are repeatedly considered to impact teamwork effectiveness (Mei-Ling et al., 2008;

Syed, 2016). During match congestion, the PHCT were also unable to maintain an appropriate structure (practitioners adopted autonomous working) and consequently adopted a multidisciplinary teamwork approach in meetings. PHCT resources are implicated by practitioners as a contributory factor to this, which have also been identified as problematic in European football clubs outside of this study (Arkenhead and Nassis, 2016).

Results in the present work suggest that resources should be a strategic priority for the PHCT, specifically around maintaining communication and collaboration between practitioners at a level that meets the demands of match congested periods. Prioritising resources could allow interdisciplinary practices can be maintained.

The resource challenges highlighted by PHCT practitioners can impact PA because of their relationships with shared decision-making. Many of the processes supporting the management of PH activities were identified by the practitioners as involving multiple members of staff and, emerged as a theme under 'teamwork reliant practices'. The support mechanism that encapsulated this notion was a 'structured interprofessional collaboration' deemed essential to the effective management of certain PH activities. For these processes to function effectively, the PHCT requires not only a diverse grouping of staff but also an appropriately resourced one that has the expertise to manage complex individual player issues. Examples of this include reference to both 'return to play' procedures and 'injury prevention' initiatives that involved multiple inputs from both PHCT members and coaching staff. This is supported in literature that has recognised an interdisciplinary approach to be commensurate with the complexity of these aspects of football PH management (Hallén and Ekstrand, 2014; Scharhag and Meyer, 2014; Shrier, Safai and Charland, 2014). Both injury prevention and rehabilitation are considered risk management exercises (Charlton et al., 2017; Dijkstra et al., 2016) where short-term errors in judgement are known to have ramifications for injury risk in players for many weeks (Orchard et al., 2009). This becomes particularly pertinent during match congestion, when the risk of perturbed health and performance is increased and the need for continued use of interdependent and interdisciplinary work becomes significant. These findings collectively highlight how the PHCT's structure as defined by ITEM further informs an understanding of the relationship between its processes and PA.

In their interactions with the head coach, the practitioners highlighted the need for their combined expertise when informing opinion and sharing their conclusions regarding appropriate courses of action. This was deemed especially important during match congestion or immediately after a loss, when the pressure on their work was perceived to rise. Having regular meetings with the head coach was viewed as important because he made the final decision on a range of matters related to PH. The literature has highlighted the necessity of 'head coach buy in' to the views of the PHCT in European football (Arkenhead and Nassis, 2016). This may be challenging because the head coach is likely to have priorities primarily focussed on winning (Ashton, 2016) and may not

always match the welfare concerns of support staff (Gilmore et al., 2018). The heads of departments were responsible for leadership and delivery of the PHCT's collective view in such circumstances, which during match congestion was often made with far less meeting time when compared to periods with less frequent competition. In these circumstances the PHCT increasingly relied on informal and mutual exchanges of information between practitioners; however, no relationship was found between this form of communication and PA in this study. Further, it was established that practitioners demonstrated higher levels of 'solution satisfaction' when they were actively involved in formal meetings, providing the basis for the relationship found between team processes and PA. That said, future research should not neglect further investigation into the potential role of informal communication outside of meetings in football due to the potential of alternative techniques not used in the present study (Pentland, 2012).

5.13 Conclusions

Using the ITEM, this study is the first to illustrate that the structure and processes adopted by a PHCT in professional football during varied match frequencies are related to the number of players available for competition. The team meeting was observed to be an important juncture that supports processes in the performance and health management of professional players. Similarly, the number of meetings, limited negativity within meetings and the practitioner satisfaction with the results emerged from them, contributed to the readiness of players for competition. When the practitioners implemented their contributions to the PHCT meetings using a multidisciplinary approach during periods of match congestion, PA was less favourable; however, outside of these congested periods an interdisciplinary approach was associated with a reversal of this trend. In order for the PHCT to continually review their work team auditing and evaluation was also associated with favourable PA as an outcome of their work. Consequently, in the present study, PA appears to be improved when PHCT practitioners work closely together and adopt interdependent team processes that are reviewed. The PHCT's structure, including its resources and team premises, further informed an understanding of these relationships. This research focussed on PHCT staff at a systems level as opposed to traditional player levels, providing a unique perspective on performance and health factors within professional football that have significant implications for the number of players available for competition during varied match frequencies.

5.14 What This Study Adds

This is the first study to demonstrate the utility of an Input-Mediator-Output model to the study of teamwork effectiveness in professional football. Consequently, the methods employed provide a foundation for modelled teamwork research in football and potentially other sports using framework-guided inquiry. The detailed illustration of a PHCT's structure provides a deeper and more context-rich level of insight than has previously been reported in the literature. The use of the team process questionnaire and reporting the number

of meetings held by the PHCT demonstrates the utility and validity of this technique for investigating non-technical skills in football and representing the team processes that are central to teamwork effectiveness and their outcomes.

By demonstrating important relationships between a PHCT's structures, practitioner interactions (non-technical skills) and the importance of meetings to the number of players available for competition, this study has contributed to a further understanding of the systems that influence PHCT outputs in a professional football setting.

Although match frequency has previously been shown to have a significant impact on PA, this study adds to these considerations by illustrating that it also the potential to impact the PHCT's structure and team member interactions, all of which have implications for the effectiveness of performance health management and potentially success in competition.

Team meetings were identified as a central process in the performance and health management of professional players as illustrated in figure 13 which, distinctly highlights the importance of team processes including communication as non-technical skills.

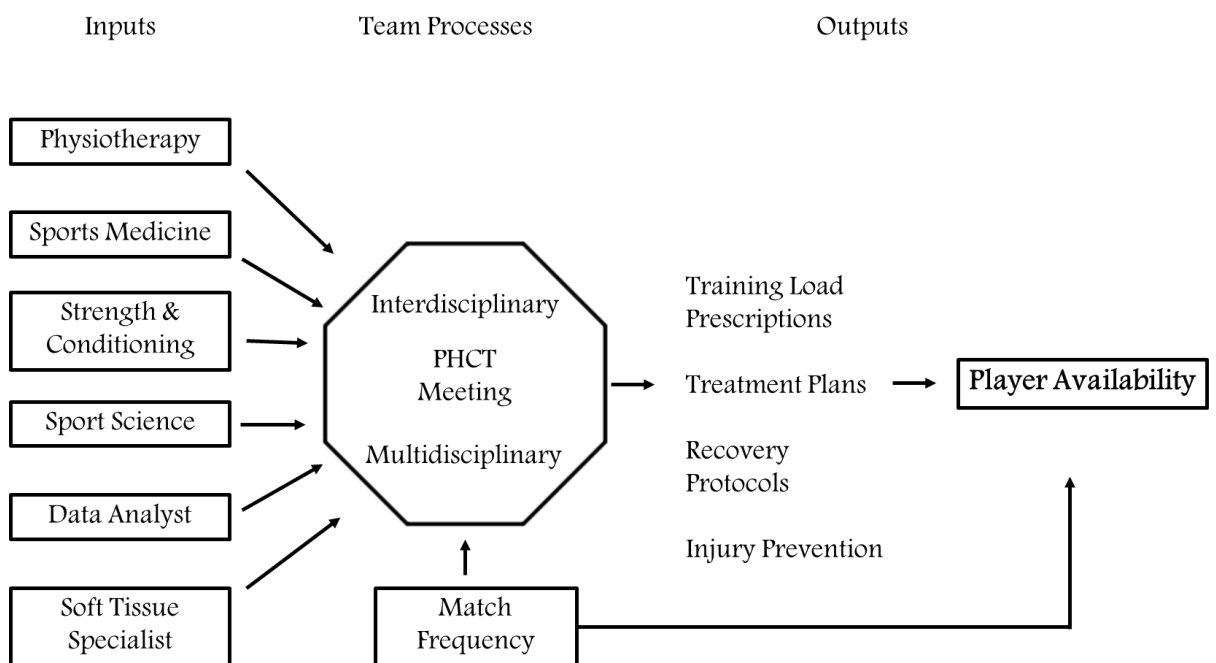


Figure 13. The Centrality of Team Meetings

The importance of interdisciplinary team processes and inherent shared decision-making provides evidence of a tangible link between off-field practitioner work and the PH of players in football. Practically, should the conditions within this study reflect those within other clubs, PHCT's should be structured to maintain interdisciplinary practices in meetings throughout all variations in match frequencies as a strategic priority.

5.15 Study Limitations

The limitation that must first be acknowledged is that the findings from this case study may have limited external validity and only reflect the circumstances of this single football club. Generalizability and implications for the wider football community may therefore be limited due the potential for this club to have rare antecedent conditions with limited explanatory range. A larger collection of clubs may have revealed different relationships between the quantitative variables and responses from the qualitative aspects of the study. However, the study has significant merits in that it was performed over an eight-month period of repeated assessments, as well as using a mixture of quantitative and qualitative techniques to gain a significant rich source of verifiable data. The participating club had occupied a position the Championship division for three seasons, representing what is arguably a good example of a team with experience of playing in one of the world's most physically demanding leagues. Consequently, this team was able to provide insight to the phenomena of interest. The study also used a well-established framework to guide its investigations and was therefore able to produce novel findings and create avenues for future research.

The small sample size and use of *Pearson* correlation analysis with associated parametric assumptions in this study, increased the possibility of committing a type-II error. Similarly, the team process questionnaire had 11 domains requiring each to be statistically tested which may have elevated the possibility of committing a type-I error. In order to assess the stability of results as well as generate better confidence in them, the bootstrap method (2000 replications) was employed to generate statistical confidence intervals. This choice was considered a better alternative than having to adopt non-parametric statistics with less power that increase the likelihood of committing these error types. The small sample size (N=14) placed limitations on the parametric techniques that could be adopted, such that the study was underpowered to detect specific associations that were expected. Nevertheless, despite this case study having limited generalisability, these acknowledgements provide the basis for future studies that consider a larger array of professional football clubs and potential findings with a wider frame of reference.

The use of a two-part questionnaire also had limitations. The PHCT processes were assessed using a previously validated group process questionnaire that was devised to assess the quality of medical team meetings based on the interaction between team members (processes; communication, collaboration, co-operation, participation and decision-making). The questionnaire had previously demonstrated good internal consistency and structural validity in medical rehabilitation settings (Cronbach's alpha 0.7-0.84) (Roelofsen et al., 2001). Part two of this questionnaire and the team structure questionnaire (used in part two of the study) were both bespoke additions, formulated to gather data on additional areas of interest. Their psychometric properties have not been fully determined, which is a limitation in this study. However, these questionnaires had their face validity assessed by a group of performance and health practitioners with over nine years of experience working in elite

professional football during a pilot test. Triangulation of responses from both questionnaires was performed by comparing the data drawn from the focus group interview, adding robustness and confidence to the findings. This method is deemed suitable to mixed method research, adding confidence to the results and enhancing the validity and reliability to the research strategy (Bryman, 2016).

Another limitation in this study is the possibility of some degree of error in the accuracy and completeness of recollections from practitioners in completing retrospective questionnaires. The participants in this study worked extremely long hours for prolonged periods of time and consequently some recall error may exist. The study required all questionnaires to be returned within 10 days of receiving them, to limit the potential for this error. Expectancy and confirmation bias of results may also be considered a limitation to this study, given the lead researcher's background as a practitioner in football. Subconscious influence on both the participants and the data analysis would therefore be possible; however, in line with the philosophical underpinnings of pragmatism, efforts were made during the qualitative analytical processes to stay close to what was said by the respondents and ensure that the responses were accurately reflected in the development of themes and subsequent explanatory accounts. To add rigor, a research observer was also given access to the data such that the interpretation of the qualitative data could be verified. For the quantitative data all analysis adhered to test assumptions.

The practitioners reported that a small number of players sought services beyond that provided by the PHCT, the impact of which on PA remains unknown. It may be that this occurred more readily during reduced competition schedules and therefore overestimated the relationship between team approach and PA. It would have been very difficult to account for all of these variables in this preliminary study, but this acknowledgement provides a basis for future work that could investigate these important contributors to the occupational health of professional football players.

Despite an average return rate over 80% for questionnaires in part one of the study, for questionnaires not included in the analysis (late returns not meeting the study criteria) 57% (16) were for periods in the season which had the highest match frequency and could indicate response bias. One practitioner was responsible for half of these questionnaires, who was newest to the team, the only PHCT member working across two squads, working on two different training grounds and unable to attend several meetings. It is possible that had this data met the study criteria and been included, it may have influenced the overall relationship between the team's processes and PA. That said, the PHCT practitioners who had their sole and full-time focus on the 1st team squad provided the quantitative and qualitative data used in this mixed method study which provided rich and detailed insight into the management of performance health. The sequential explanatory approach provided a robust format for data collection in which the quantitative data in the study part one, provided a platform upon which, the qualitative aspects of the study could be used to

further inform more holistically guided discussion and conclusions drawn from results.

5.16 Future Directions

Future research should continue to consider teamwork models and systems level factors that influence the performance and health of professional football players. There is a need for further exploration relationships between team processes and player availability, with additional reference to the head coach and other coaching staff. This is important because of the hierarchical nature of elite football and the role played by these individuals in team processes during frequent competition. Moreover, the research could be extended to include a greater number of clubs and a smaller number of team-process domains, moving away from the case study format. Given the significant emphasis in this environment on 'winning the next game', future research should also consider the impact of teamwork effectiveness on PA and subsequent success of teams in competition.

5.17 Practical Implications and Guidance

The PHCT in this club, should prioritise team meetings through all cycles of their season as one of the most important junctures in the performance and health management of their squads. However, in this study resources were deemed problematic particularly during match congested periods. The balance between the need for staff to be creative with the resources the PHCT have at their disposal and the need for further investment is important, with implications for the number of players available particularly during match congestion. At all club levels, it would therefore seem pertinent for executives to evaluate both the economic and performance implications that limited resources can have on their objectives. This should bear in mind the fact that unavailable players can have significant performance and financial costs. With these considerations in mind and the fact that foreign players felt the need to use resources provided by practitioners not employed by the club, the structure of the PHCT should be re-examined. The aim must be to consider changes that allow the PHCT to remain stable in its ability to adopt an interdisciplinary teamwork approach, particularly during match congestion. As highlighted by the PHCT, this may involve the employment of rehabilitation specialists or other personnel that could be permanently based at the training ground to provide continual squad support. This would mean that even when many of the PHCT members have high workloads or are away on competition duty, those players unable to compete have dedicated staff to care for them.

The PHCT should consider regular combined meetings with the head coach and coaching department to foster a better working relationship during challenging periods of the season and to lay a foundation for closer integration of their work. All staff should consider the impact and implications of altered decision-making processes when results are not favourable. In order to do this the PHCT could present this as case studies, profiling the implications of e.g. adjusted training loads on the health and performance of squad members. The

head coach and coaching staff will no doubt have their reasons for such decision-making during highly pressured phases of the season, but it remains the PHCT's responsibility to protect both the short and longer-term health of players and further inform the coaching staff of the implications of their actions. Interdisciplinary approaches to work should therefore be considered to cross into the coaching department, the processes for which should be bound by mutual agreement with the PHCT. In other words, the results-driven environment that pervades this club and many other football clubs should be shaped to be a process-driven one as well.

The limited audit/evaluation reported by the PHCT was nevertheless positively associated with improved player availability. Although causation cannot be inferred, it would seem appropriate for this area of practice to become formalised and potentially more detailed. Evidence across a wide array of organisations illustrate the benefits for staff morale, team learning and outcomes of multi-disciplinary work, warranting further investment of time and resource.

The need to win the next match is clearly what drives the activities of both the coaching and the PHCT staff; however, if the structures and processes that support uninterrupted training and greater PA are to be properly addressed, their longer-term perspectives need consideration. The typically short tenure of head coaches and management in football is a significant contributor to short term planning (Ashton, 2016). Nevertheless, if player availability is to be optimised, a longer-term view of how the two departments' working arrangements can be improved is also required. The working practices and culture of the club should be masterminded by the director of football, who currently sits alongside both groups in the structure of the football organisation. Communications of culture in football clubs typically originate from head coaches and performance directors who have responsibility for driving the organisation and /or team towards meeting its performance aims (Arnold, 2012). Aligning the culture of all departments could serve to optimise the decision-making processes during phases of the season when results are not favourable, as well better meet the challenges the PHCT face in an environment focussed predominantly on keeping players available and winning football matches.

Several performance and health management issues arise when players use services outside of the football club's guidance, as reported in this study. What was clear from PHCT discussions was their concern regarding the ambiguity around who is responsible for the outcomes of such arrangements. Ultimately, players may be within their rights to use alternative services, particularly if the club has unresolved resource issues. However, it leaves the PHCT in a very difficult predicament as they ultimately have responsibility for the football squad's health and wellbeing. Practitioners reported that they often had limited knowledge of the services being received by players who had chosen to follow such a route or the level of expertise of the practitioners involved. This issue might best be served at higher levels within the club when players initially sign a contract to join a club alongside their initial medical assessment. The procedure

could include reference to the working practices expected of players in this football club and its culture as defined by the leadership. Given that all players go through this process, it would seem to be the most appropriate point at which to begin this dialogue. Given the importance of well-co-ordinated performance and health management to PA, competition and the overall club business success, these matters should be addressed as a matter of high priority.

Appendix 1 Informed Consent



University Address: Claverton Down,
Bath, United Kingdom BA2 7AY

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Bath, United Kingdom BA2 7AY

Participant Information and Consent Form

Study Title: Performance Health Management in English Professional Football.

Principle Investigator: **Kunle Odetoyinbo**

Investigator Supervisor: Dr Carly McKay (Bath University)

You are invited to participate in the above titled research study that I (Kunle Odetoyinbo) plan to conduct as part fulfilment of a Professional Doctorate at the University of Bath. Your participation is voluntary. You should read the information below and ask questions about anything you do not understand, before deciding whether to participate. Please take as much time as you need to read the consent form. You may also decide to discuss participation with your family or friends. If you decide to participate, you will be asked to sign this form and given a copy to keep.

Purpose of Study

The study has been designed to establish whether the processes (interactions between team members) of the performance healthcare team (practitioners involved in performance and or health related work but not technical coaches) within the club that you work, have any association with player availability and match frequency over the course of a competitive season. The study also seeks to describe the structure of a performance healthcare team in a professional football club setting.

Study Procedures

If you volunteer to participate in this study, you will be asked in phase 1 of the study to complete a questionnaire focused on PHCT processes (team member interactions) twice per month from September until May. The team process questionnaire has 32 tick box questions and will take approximately 10 minutes to complete. Your team will also be asked to provide the research team with the number of players available for selection for each game including those players suspended for technical only reasons.

Phase 2 of the study will take place at the end of the season where you will be asked to complete a single questionnaire which seeks to understand how the PHCT was structured during the season. This questionnaire takes the form of open and closed questions and will take approx. 10-15minutes to complete.

The final requirement of the study will involve a Focus Group discussion to gather your views on team process, player availability and match frequency. This session will be audio recorded for later transcription. This will take approximately 1-1.5 hours and involve the whole PHCT. If you wish not to be audio recorded, then you cannot take part in this session although your previous data will still be used for interpretation of results. The study is therefore season long requiring you to commit a small amount of time each month.

Potential Risks and Discomforts

A minimal number of conceivable risks are associated with the study. The research team recognizes that at times it might be inconvenient to complete a questionnaire during busy periods but have placed a great effort into minimizing the questionnaire requirements. The second part of the study which involves a focus group discussion and descriptive questionnaire will happen at the end of the season at a time best suited to the team.

Potential Benefits of the Research

The work of backroom staff is considered extremely important and it is hoped that this research will shed further light on how both the structure and processes adopted by a PHCT are important features contributing to the performance and health of players and ultimately competition and club success.

Payment and Compensation

There is no payment for contributing to this study, but it is hoped that the findings will of benefit to your practice which will be shared with your team. A small lunch will be provided after the Focus Group discussion.

Potential Conflicts of Interest

The project is being conducted with your safety and the utmost integrity in mind and will be guided by the lead supervisor at the University of Bath. The principal researcher does not currently work with any other sporting institution in direct competition with the club and declared no conflict of interest in conducting this work.

Confidentiality

Any identifiable information obtained in connection with this study will remain confidential. If the results of the research are published or discussed in conferences, no identifiable information about the football club or you personally will be used. Any further use of data beyond the initial project will be for research only e.g. for follow on research.

Participation and Withdrawal

Your participation is voluntary, and your decision to enrol in the study should be made free from coercion, whether explicit or implied, from any source. A refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may also withdraw your consent at any time and discontinue participation without penalty. Your information to this point will also be withdrawn unless you consent to it being maintained. You are not waiving rights because of your participation in this research study. If you decide not to participate today but change your mind at a later date, the research team will endeavour to include you in the study.

Audio Recording

Part of the study involves a focus group interview, which would need to be audio recorded (using a Dictaphone) to capture the information discussed. This would then be transcribed for subsequent analysis. For this we would like to ask your permission

(please tick the appropriate box below). Should you not wish to participate in this part of the study, you are still able to continue with the other elements of the project.

- I agree to be audio recorded in the focus group discussion

- I do not want to be audio recorded during the focus group discussion

INVESTIGATOR'S CONTACT INFORMATION

If you have any questions or concerns about the research, please feel free to contact the principal researcher (Kunle Odetoyinbo, ko280@bath.ac.uk, mobile. [REDACTED] or my supervisor Dr Carly McKay email C.D.McKay@bath.ac.uk

ASK QUESTIONS

You should ask as many questions as you see fit before you decide on whether to participate you are under no obligation to take part.

RESEARCH INTEGRITY

This project has been reviewed by the Research Ethics Committee for Health University of Bath and will follow strict guidance on ethical considerations including Data Protection and Freedom of Information. The personal data from this study will be kept anonymous and where electronically stored password protected by the principal researcher. At the end of the study the club will be presented with the findings. Data will be stored for research purposes after the study in an anonymous format. For further guidance on this matter please feel free to speak with the research team.

I fully understand what is involved in taking part in this study. Any questions I have about the study, or my participation in it, have been answered to my satisfaction. I have been informed that I am free to withdraw my consent and discontinue participation at any time. If I decide to withdraw, I understand that it will not have any undesirable consequences.

Please check:

I understand that this research is being conducted in accordance with the Declaration of Helsinki (2013) and that it has been approved by the Research Ethics Approval Committee for Health at the University of Bath. I understand that all information that is collected from me will be held for research purposes in accordance with the Data Protection Act (1998).

Please check:

I understand that my personal information will remain confidential within the research team and I will in no way be personally identified in any report or other published materials following the study.

Please check:

It has been made clear to me that, should I feel that these regulations are being infringed or that my interests are otherwise being ignored, neglected, or denied, I should inform the study supervisor, Dr Carly McKay, c.d.mckay@bath.ac.uk / 01225 385544, who will investigate my complaint.

Please check:

Participant:

Name of Participant

Signature

Date

Researcher:

Name of Researcher

Signature

Appendix 2 Team Process Questionnaire

This questionnaire intends to assess your perception of performance health care team processes that work towards optimising the performance health of players. By 'Process' we refer to all of the activities that involve planning/delivering through your work to optimise performance health of the football squad. It is extremely important to answer all questions in relation to the specified period. For most questions a scale is presented for which you should mark the circle that you deem appropriate to the response that best fits (example below). All answers are strictly confidential and should be returned to the research team upon completion. This section relates to the period matches to covering dates

Example: Has the frequency of matches in any way impacted your work ? (you may mark the appropriate circle)	1. not at all	2. to a little extent	3. to some extent	4. to a great extent	5. to a very great extent
Team Meetings	1. not at all	2. to a little extent	3. to some extent	4. to a great extent	5. to a very great extent
1. Did you make suggestions about the way in which performance and or health related plans can be accomplished?					
2. Did you ask for suggestions from other performance health care team participants?					
3. Did you provide information about the situation and opportunities of players ?					
4. Did you ask others about their ideas and opinions?					
5. How much attention to and interest in the contributions of other performance health care team participants did you show?					
Team Meetings: Negative Interactions	not at all	to a little extent	to some extent	to a great extent	to a very great extent
6. Did others express a negative opinion about your behavior?					
7. Did you reject other people's opinions or suggestions?					
8. Did others reject your opinions or suggestions?					
9. Did you express negative opinions about anyone's behaviour?					
10. Did you feel frustrated or tense about other people's behaviour?					
Team Meetings: Result Satisfaction	not at all	to a little extent	to some extent	to a great extent	to a very great extent
11. To what extent are you confident that the performance healthcare plans were appropriate ?					
12. To what extent are you committed to the performance healthcare plan?					
13. To what extent did the final overall plans reflect your contributions?					
14. To what extent do you feel personally responsible for the appropriateness of the performance healthcare plans?					
15. How satisfied are you with the quality of the performance health care plans?	very dissatisfied	somewhat dissatisfied	neither satisfied Nor dissatisfied	Somewhat satisfied	Very satisfied
16. Team Meetings	Inefficient				Efficient
(Process Satisfaction: the amount of satisfaction concerning the discussion process)	1	2	3	4	5
16. How would you describe the team meetings during this period?					
inefficient-efficient					
Uncoordinated-Coordinated					
Unfair-Fair					
Confusing-Understandable					
Dissatisfying- Satisfying					

Team Meetings: Goals/Objectives		not at all	to a little extent	to some extent	to a great extent	to a very great extent
17. To what extent did you achieve your goals during this period?						
18. To what extent did the performance healthcare team have shared performance health objectives during this period?						
19. To what extent did the members of the team pull in the same direction during this period?						
20. Were the performance healthcare team objectives clear during this period?						
21. Would it be fair to say that the main objective of the performance healthcare team is to optimise player availability for competition during this period?						
Team Meetings: Team Audit/ Evaluation		not at all	to a little extent	to some extent	to a great extent	to a very great extent
22. To what extent was the teams' work evaluated during this period?						
23. Did any of the PHCT provide feedback regarding your contributions during this period?						
24. To what extent has your work been innovated/changed during this period as a result of feedback and or evaluation?						
Additional Single Items		not at all	to a little extent	to some extent	to a great extent	to a very great extent
28. During this period how many meetings did you attend ? (state number only)					
29. Was there regular contact among PHCT members during this period?						
30. Did you have <i>frequent informal and mutual exchanges</i> with PHCT members to discuss performance/health matters?						
31. Did you feel you had influence on team decisions during this period?						
32. During this period did the frequency of matches impact any of the following;						
a. Frequency communications and information exchange with other team members outside of formal meetings?						
b. Coordination of activities that involve other team members outside of formal meetings?						
c. The decision making process between performance health care team members?						
d. Collaboration with other team members?						
Definitions: Multidisciplinary team (professionals working together towards their own goals): Interdisciplinary team (professionals working together predominantly towards shared goals)						

Appendix 3 Team Structure Questionnaire

Final Team Structure Questionnaire: Department _____						
<p>The following questionnaire seeks to gather information relating to the structures that have been adopted by the performance health care team over the course of the season. Please complete each section of the questionnaire fully. If you are unsure of any aspect of the questionnaire please refer this to a member of the research team. Your answers are strictly confidential. The questionnaire should take approximately mins to complete.</p>						
Q. No.	Questions	Guide	Answer/Response			
Q.1	What has been your official position and title this season?	State				
Q.2	Were you employed full or part time?	Tick box as appropriate	FT	<input type="checkbox"/>	PT	<input type="checkbox"/>
Q.3	How long have you been in your current role?	State	Years		Months	
Q.4	Do you consider yourself a member of a support team responsible for the performance and or health?	Tick box as appropriate	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Q.5	Which discipline do you represent? e.g. physiotherapy	State	add note if req'd			
Q.6	Approximately what % of your role requires specialist knowledge/expertise that contributes to the performance health of players?	Circle as Appropriate				
Q.7	Did any of the tasks you performed require the use of any particular rules/guidelines or procedures?	Tick as appropriate	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
			If yes please briefly describe below.			
Q.8	Would you describe your job/tasks as predominantly interdependent or autonomous in its delivery?	Tick box as appropriate and briefly describe	Interdependent	<input type="checkbox"/>		
			Autonomous	<input type="checkbox"/>		
Q.9	Where are you situated geographically on a daily basis in performing your tasks relative to most other team members?	Tick a box most appropriate	In very close proximity			<input type="checkbox"/>
			Quite close			<input type="checkbox"/>
			Quite far away			<input type="checkbox"/>
			Isolated far away			<input type="checkbox"/>
Q.10	What roles do you play in optimising the performance health of the football squad? e.g. strength and conditioning.	Briefly Describe				

Appendix 3 (continued)

			Inter-disciplinary	Multi-disciplinary	Changeable depending upon circumstance	Neither	Comment
Q.11	Would you consider the performance health care team to be structured as an interdisciplinary or a multidisciplinary team to meet its objectives? (See definitions below).	Tick box as appropriate and add further comment					
Q.12	With which discipline of staff do you collaborate and interact most with in your work and why? e.g. massage therapists	Please State and describe reason(s)					
Q.13	To what degree does the wider organisation outside of the performance and healthcare team support innovation and change?	Circle as appropriate	<p style="text-align: center;">none at all to some extent to a very great extent</p>				
Q.14	What roles have you played in player availability decisions over the course of the season?	Briefly Describe					
Q.15	To what extent has your functional area been integrated into the performance healthcare team activities?	Circle as appropriate	<p style="text-align: center;">not at all to some extent to a very great extent</p>				
Q.16	In your role during the season did you report to someone in the team?	If yes please state	Yes <input type="checkbox"/>	No <input type="checkbox"/>			
Q.17	Do you have a structure or procedure for resolving conflict within the performance healthcare team?	Briefly Describe					
Q.18	Does the organisational structure outside of the performance health care team support further training and technical assistance?	If yes please state	Yes <input type="checkbox"/>	No <input type="checkbox"/>			
Q.19	How do you influence player availability decisions during the season?	Please state					
Q.20	Does the frequency of matches have any impact on the structure of the performance health care team over the course of a competitive season?	Briefly Describe					

Appendix 4 Pilot Study Feedback on Surveys

Discipline ID code.	Team Process Q. Time To Complete	Team Structure Q. Time To Complete (min)	Summarised Feedback/Comments	
			Team Process	Team Structure
1. Physiotherapy	10	15	Easy To Complete, a little repetitive in places. What about coaching?	Simple and straight forward
2. Podiatrist	9	15	Titles are a bit leading. Was simple to follow otherwise	Working across two disciplines
3. Sport Science (psychology)	12	15	Would be easily completed on a monthly basis even though questions ask similar things	More space for filling in brief answers needed
4. Sports Science (physiology)	15	15	No problem completing	Brief descriptions could have written more space to complete
5. Strength and Conditioning	10	15	Was fine but do you want the titles indicating what you are looking for?	No Problems
6. Sports Massage	10	20	Seem to ask similar questions many times over regarding contact.	Easily understood and completed
7. Team Doctor	10	15	Confusion over decision making processes, q. 32c	Was straight forward
8. Performance Nutritionist	10	15	I rarely attended team meetings as a part time member of staff	No problems
9. Sports Analyst	10	20	A lot of back up questions fully understand	Had no issues
10. Performance Director	8	25	Interesting simple to complete	Easy to fill in but order or questions could be better
Average Time To Complete min. (mean\pmsd)	10.4\pm1.9	17\pm3.5		

Appendix 5 Focus Group Discussion Guide

~ Time Allocation	Focus Group Discussion Guide
Introduction 5 minutes	Welcome and thank you all for agreeing to take part in this group discussion. You have been invited because you are members of the PHCT and the purpose of this discussion is to elicit your views on differing aspects of PH management within BCFC football club 2017-18. There are no wrong answers only points of view and I am interested in all angles of thought that you can bring to the discussion. The session will be recorded for subsequent transcription and to ensure nothing is missed as writing everything down will be impossible. Information will remain confidential for research only. The session will be last for a maximum of 1.5 hours. Please introduce yourself and your position in the PHCT for the purpose of the recording and we can begin. Please participate as much as possible everbodies points are relevant.
Introductory Question	<ul style="list-style-type: none"> • Round Robin: How do you feel about being described as a performance and healthcare team? Would you consider it an appropriate term?
Team Process ~20 minutes	<ul style="list-style-type: none"> • Looking Back On The Season, In What Ways Have Team Meetings Been Important In Your Work As A PHCT? <ul style="list-style-type: none"> • Have Meetings Facilitated Your Decision Making Processes? • How Might The Frequency Of Matches Impact Team Structure/Processes? • How Do You Think Your Processes Influence Player Availability?
Team Structure ~20 minutes	<ul style="list-style-type: none"> • Would You Summarise Your Roles As Performance And Healthcare Specialists? <ul style="list-style-type: none"> • How Does Your PHCT Structure/Design Influence These Roles? • Is There A Priority Between Performance And Health During Periods Of The Season? Do You Think The Wider Organisation Of The Football Club Has A Role To Play In Your Work?
Team Audit ~10 minutes	<ul style="list-style-type: none"> • Is It Important To Audit Yourself As A Team? If So How Do You Do It And Provide Feedback To Each Other?
Team Goals/Objectives ~10 minutes	<ul style="list-style-type: none"> • How And Who Sets Goals For The PHCT? As A Team Do You Tend To Have Shared Objectives? • Over The Course Of The Season Have You Been Part Of Any Innovation Or Change Of Practice As A Consequence Of Feedback From Any Source? • Can You Recall Periods In The Season When Regular Contact Between The Team Has Been Limited? Did This Have Any Impact On Decision Making, Collaboration or Co-ordination With Team Members? • Was This Particularly Important During High Frequency Of Matches e.g. the month of feb/March??? How Would You Describe The PHCT Processes, As Interdisciplinary or Multidisciplinary and Why? (Give Definition) <ul style="list-style-type: none"> • Is the Main Objective Of The PHCT to Optimise PA?
Summary and Other Questions That Emerge (20 minutes)	What relationships exist between your non-technical skills as a phct and PA? Is this influenced in any way by match frequency? The purpose oof this discussion was to elicit your views on PH management considering team structure, process and match frequency and player availability. Did I miss anything?

Appendix 6: Study Participation and Completion Rates

Participant No.	Date Accepted	Oct.		Nov.		Dec.		Jan.		Feb.		Mar.		Apr.		May	Team Process	Team Structure	Focus Group	End Season Review
1	13/10/17																7			
2	13/10/17																10			
3	14/10/17																10			
4	13/10/17																7			
5	13/10/17																14			
6	13/10/17																14			
7	13/10/17																13			
8	13/10/17																14			
9	13/10/17																14		18 mins.	
10	14/10/17																9			
%completion rates		100	100	70	70	70	60	70	80	90	90	90	80	80	80	80.00	100%	50%	100%	

Appendix 7: Example Coding Matrix

Example Coding Matrix: Focus Group Interview				
Focus Group Transcript		Descriptive Code	Preliminary Thoughts	Initial Category
Source	Part 1: How do you feel about being described as a performance and healthcare team?			
G7	..although we are separate its more of one team if you like..'	working as one team amongst teams	collectively operating as a multi-disciplinary team	Working as one team
D4	..the importance of having an holistic approach rather than just five bits of input from 5 different departments..'	considering all expertise	making use of all resources	Considering all inputs
C3	...definitely in the last couple of years its amalgamated a lot more and kind of evolved hmm and kind of working much closer together'	increasingly amalgamated team	collaborative practice increasingly with time	Evolving collaboration between practitioners
A1	we have the same goals and objectives in terms of improving player availability and things like that..'	PHCT goals/objectives	Shared Objectives	collectively supporting PA
I9	yes it's a combined effort trying to bring all expertise to improve health and performance and a good description..'	combining efforts of the team	agreed with term	PH teamwork approach
D4	..going down the route of having a head of performance in place..'	head of performance	Lead collaborator	leading an interdisciplinary team
G7	...good balance where there is interaction between staff..'	teamwork	collaborative practice	Practitioners interdependency
C3	..the return to play work, its been really important for us all to work together to try and maximize the resources...'	working collectively	collective practice and return to play	Return to play
C3	..maximise performance.....at the end of the day that is what we are aiming to do whether that's from a medical side, physical science the emotional side and then the sport performance'.	Performance objective	overall aim performance	collectively max. performance
Source	Part 2: Looking Back On The Season, In What Ways Have Team Meetings Been Important To The Collective Work Of The Team?			

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G7	..meetings are really important for us we discuss every day injuries and training loads..'	daily meeting	co-ordination through meetings	Meetings for squad management
D4	..me a platform and Steve to have our input from our relevant areas of expertise but the guy that makes the final decision on how he wants to operate is the head coach.'	input to final decision making	Ultimate decision lies with H Coach	Informing final decisions
C3	..gets us all on the same page and gets it running efficiently really'.	shared information through team meetings	PHCT teamwork efficiency	PHCT collaborative practice
D4	..get everyone together and talk about things especially if you've got a difficult case or a difficult player '	staff to work together	Teamwork effectiveness	PHCT co-ordination
G7	putting amount of load through a certain joint so, we back each other to the core and discuss things openly after .	staff open with each other	Professional engagement	Professional interaction
Source	Part 3 so you are working very closely together as a group is the structure of the team important?.			
G7	..it is vitally important you have a clear lead and you have a line downwards so that everyone knows what their roles and objectives are'.	leadership of roles and objectives	teamwork leadership	Leadership
G7	..important how you are as a human being and how you interact and treat people..'.	individuals within the team	interpersonal skills	Non-technical skills
I9	..as analysts we provide constant flows of analysed data to support decision making but are not always involved closely in day to day stuff but are part of the structure which is important.'	data integral part of structure	could be a new addition to framework	Team data management
D4	...by having them in the department we are covering a broad range of skills and skillsets and that's important...'	broad range of skillsets	discipline diversity	Diversity
Source	Part 4 How are very specialist skills in the department important? 4. (asked later) How Does The Context Of The Football Environment Influence How You Structure The Team?			

C3	So I think as a team we complement each other and these specific skills are important but you don't need to necessarily have them all but you need to have someone within the team...'	specialist skills	complementary skillsets	Specialized knowledge/expertise
G7	...so he knows and understands how a football environment works and he is very good at his job. I think football is a one-off environment..'	knowing the football environment	combining experience and skills	Understanding the football environment
Source	Part 5 Do you think the wider organisation has a role to play in your work?			
C3	We don't always get our way and he has the final say even on significant parts of our work...'	final say on decisions	head coach consider part of wider organisation	Head coach decisions
G7	You have to work within the framework of the football club...'	work within framework of the club	hierarchical club	Wider organisation
Focus Group Transcript		Descriptive Code	Preliminary Thoughts	Initial Category
A1	'..the resources that other teams have are far better and bigger than what we have got in terms of financial, facilities..'	limited resources	competing with bigger clubs	Resources
I9	..we need support from them because ultimately they employ us and they are interested in our statistics for the club profile so we work together'.	link with wider club	analysts role may stretch more widely	Internal/ external relations
C3	...the consistency of approach then over the course of the season..'	consistency of approach	not being distracted by emotions during season	Consistency of practice with winning and losing
D4	Its an emotional game with highs and lowsto detach yourself from that when you are making decisions..'	detach from emotions	Emotional challenges to decision making	Consistency of practices
Source	Part 6: Player Availability seems to be a big parameter for you all how important is it?.			
C3	...to make the most amount of players available for the manager at any moment in time..'	Optimising PA	role of PHCT	Task Type

Appendix 7

D4	available as much as possible . So absolutely that's why we need that guy out on the pitch and healthy really	Optimising PA with limited resources	resource optimisation	Resource Implications
C3	We do bring in additional (you are talking about diversity...'	Ancillary staff	Support staff	Diversity/Size of Team
G7	..a tiny % gain that is going to help them and the outcome for us..'	marginal gains	maximising use of resource	Resource Implications
Focus Group Transcript		Descriptive Code	Preliminary Thoughts	Initial Category
Source	Part 7 The recovery periods between matches in all sports seems to be getting smaller, how does match frequency affected you guys?			
D4	..had a cup run this year which has been challenging and I think more than the cup run being a physical challenge it has been an emotional one ..'	demands of a season	physiological and psychological challenge	Match frequency impacting workload
D4	Preparing to play Manchester City on Tuesday, it's easy to prepare for that...but then to be ready for Millwall on Saturday..'	Short recovery challenge and match type	impact on staff	Match Type
C3	..quite a lot of away trips on a Tuesday and a Saturday sometimes which have been ...so they felt like they have lived away...'	many away matches in short periods	demands of travel	Travel stress impacting workload
A1	...workload increases quite heavily when the matches are thick and fast , just from an intervention side and the independent side of soft tissue...'	Workload spike	Workload	Match frequency impact on workload
G7	And that is constant for a 54 game season with the cup run which is tough, really tough' !	High workloads during match congestion	Tough schedule for PHCT	Work Cycle
Source	Part 8 Do you have shared objectives during busy periods?			
C3	..You have a focus for the short term the next game but you have got to turn your attention to the ones that have got long term injuries..'	Injuries split the PHCT	Working in the same direction difficult	Split focus between performance and injuries

Appendix 8: Analysis and Results Map.

Strategy	Sample Period	Goal	Analysis	Results Section Order of Presentation	Synthesis
Administer Team Process Questionnaire	In-season October 2017-May 2018	Quantify Team Process and relate to Match Frequency (MF) and Player Availability	Pearson Correlations	Research Question One	Merging (Discussion Section)
Determine Player Availability		Relate Player Availability to Match Frequency			
Determine Match Frequency		Determine if Match Frequency Moderates relationship between Team Processes and PA			
Administer Team Structure Questionnaire Phase 2	Post-season Early May 2018	Describe Team Structure	Content Analysis	Research Question Two	
Focus Group Discussion Phase 2	Post - season Mid/End May 2018	Establish Team Structure and Process Relations	Framework Analysis	Research Question Three	

Appendix 9: Example Team Structure Content Analysis

Survey Question: What roles have you played in PA decisions over the course of the season?			
Condensed Meaning Units	Codes	Category	
Support Through Practice, feedback T Recovery (Stis)	Recovery Feedback	Readiness To Compete	
Advise Manager Potential Injury M (Phy)	Injury Risk Advice	Risk Of Competition	
Advice M Progress Of Treatments, Rec Trg/Comp (phys)	Recovery Advise, Inj. Management	Readiness To Compete Again	
Provision Information Comp/trg (M T) (ssci)	Information Feedback	Support Data	
Prevention, Advice Readiness 4 Comp (T) (ssci)	Injury Risk Advice, Inj. Management	Risk Of Competition	
Feedback Response Treatment To (T) (phys)	Feedback Inj. Management	Readiness To Compete	
Advice Judgement Using Team Feedback (M) (med)	Advise On Potential PH	PH Potential	
Feedback Player Advancement (T) (phys) (phys)	Feedback Health	PH Potential	
Patterns Of Information , Comp/trg (anal)	Information Feedback	Analytical Support	
Information Feedback Trg/Comp (C,T,M) (anal)	Information Feedback	Analytical Support	
<p>Key: Information transferred to; coach (C), Manager (M), PHCT (T) Source Of text: stis= soft tissue specialist, phys = physiotherapist, med = medical lead, ssci = sport</p>			
Example Codes	Category	Theme	ITEM
"Give Info On Recovery"	Readiness To Compete	PHCT Info. Sharing	conceptualises a link between structure and outcome i.e. structure of PHCT and PA (perceived)
"feedback on recovery status of players"			
"info on response to treatment"			
"advise on potential injury"	Risk Of Competition	PH Balance	
"advise...chances of injury"			
"constantly providing KPIs"	Analytical Support	Advise Head Coach	
"match statistics and patterns"			
"previous performance data"			
"I Make Medical Judgements"	PH Potential		
"Feedback on treatment progress"			

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