'How' a multidisciplinary team worked effectively to reduce injury in a professional sport environment

Received: 4 May 2019
For correspondence:
jasonctee@gmail.com

Jason C. Tee^{1,2} and Fieke Rongen²

¹ *Department of Sport Studies, Faculty of Applied Sciences, Durban University of Technology, South Africa,* ² *Carnegie Applied Rugby Research (CARR) centre, Institute for Sport, Physical Activity and Leisure, Carnegie School of Sport, Leeds Beckett University, Leeds, United Kingdom.*

Please cite as: Tee, J.C., & Rongen, F. (2020). 'How' a multidisciplinary team worked effectively to reduce injury in a professional sport environment. *SportRxiv*. <https://doi.org/10.31236/osf.io/7qh4c>

ABSTRACT

In professional team sport, managing injury risk depends on the effective collaboration of technical/tactical coaches, strength and conditioning coaches, sports medicine practitioners and sport scientists within a multidisciplinary team (MDT). Yet, to date no research has examined how these professionals might co-ordinate their efforts. The aim of this study is to examine the processes and interactions utilized by a demonstrably effective MDT. The efficacy of the MDT was established by quantifying the injury burden of the team across two seasons. The MDT achieved a 60% reduction in team injury burden during the second season (first season 516, 95%CI 491 to 542 vs. second season 205, 95%CI 191 to 219 days/1000 hours). Semi-structured interviews were conducted with all MDT members to determine each individual's role

within the injury prevention process and how these were co-ordinated between disciplines. Thematic analysis identified three key constructs that contributed to the MDT's success; 1) shared values, 2) expertise and 3) the effective operationalization of underpinning values and expertise. Shared values expressed by the MDT members included 'future performance is driven by healthy performers', and shared responsibility for injury prevention. All MDT members were experts in their own fields but identified that they had to learn how to be effective within the environment and required skill in building interpersonal relationships. The operationalisation of these principles took place through iterative plan-do-review cycles underpinned by sophisticated data collection and monitoring and the provision of time and resource to complete these operations. This research offers insights into "how" effective MDTs work to achieve injury reduction, and the models and processes presented will inform practice for other MDTs working in sport.

INTRODUCTION

In sports, the prevention of injuries represents a significant challenge. Injuries emerge as the result of the interactions between a range of intrinsic and extrinsic risk factors (1, 2). As such, injury occurrence is a complex(3) and context specific (4) phenomenon. Understanding, and ultimately influencing injury outcomes requires a broad range of professional skills and perspectives, resulting in the need for multidisciplinary collaboration (5-7). Accordingly, it is now common practice for professional sports teams to employ doctors, physiotherapists and sport scientists to support coaches in injury prevention (8, 9), creating a unique multidisciplinary team (MDT). These MDTs have the potential to improve player care by integrating and interrelating different professional perspectives to provide the comprehensive understanding and interventions required to reduce injury risk (7, 10, 11).

Within healthcare, multidisciplinary collaboration is now accepted as best practice for managing a number of complex medical conditions (12-15), and has been associated with a number of positive effects regarding accuracy, timing, outcome and experience of treatment for patients.(13, 16-18). Similarly, within the sports injury prevention literature, a limited number of case studies have already demonstrated the effectiveness of MDTs in improving injury outcomes in sport settings (6, 7, 19).

Despite these positive indicators, multidisciplinary team working is not without its challenges. There are often differences in opinion within and between professionals from different disciplines regarding how best to address particular problems (20, 21). In the context of sports teams, coaches and administrators are often required to integrate the advice from different professionals, and do this within the context of their own personal philosophies and understanding (20). As a result, conflict frequently emerges within MDTs

(10, 20). Other practical challenges to effective MDT working include the lack of regular meetings, non-attendance or non-availability of MDT members for meetings, scarcity of administrative support, as well as poor information available at meetings and deficient record keeping (22). In sport settings, additional MDT challenges may include competition for resources, task interdependence, jurisdictional ambiguity and a variety of communication barriers (20).

Recently some researchers have proposed methods and structures for effectively integrating multidisciplinary professionals within performance support teams (7, 11, 21). In particular these researchers have emphasized aspects such as the need for shared responsibility, collaborative decision making, open communication, adequate time and resources and clearly defined roles and responsibilities. While many of these theoretical assertions as to the conditions required for effective MDT working seem intuitively correct, research investigating the processes and practices of MDTs is limited, particularly within high performance team sport environments. Indeed, despite the widespread employment of MDTs within professional sport no research has documented the working practices of these groups. Therefore, the aim of this research is to investigate the working practices and contributory contextual factors of a MDT that has been demonstrably effective in injury reduction within a professional sports setting.

METHOD

This study utilized a qualitative design. One professional academy's MDT (consisting of a head coach, assistant coach, strength and conditioning coach, physiotherapist and sport scientist) were all invited to participate in individual semi-structured interviews to explore the processes and practices related to injury prevention within the team.

This professional rugby league academy was purposefully sampled from within a larger ongoing injury surveillance project due to the academy's impressive injury record during the 2018 season. Within this larger project, data on the incidence and severity of all match and training injuries in the squad were collected by the team physiotherapist according to the methods described by Tee et al. (2019), for the duration of the 2017 and 2018 seasons(23). Injury incidence was calculated as the number of injuries per 1000 player exposure hours (match and training injuries inclusive). Injury severity was reported as the mean $\pm$ standard deviation (SD) number of days players were unable to participate fully in training and match play. Injury burden was calculated as the total number of days lost to injury and then normalized to 1000 hours exposure (total days absence per 1000 player-hours).

The academy was selected for two reasons; 1) in 2018 the team had a significantly lower injury incidence than other teams competing in UK academy level rugby league, 2) in 2018 the team reduced its injury burden by 60% from the previous season (Table 1). Injury

incidences and burdens were considered significantly different if the 95% confidence intervals did not overlap (24). The average seasonal variation in injury incidence in rugby league is 24% (25) indicating that the improvement observed is unlikely to be explained by normal season to season variation. These changes in injury outcome occurred under the management of a newly assembled MDT (the head coach and physiotherapist were employed at the start of the 2018 season, while the strength and conditioning coach and sports scientist each had less than a years' experience in their roles within this context.) It is the contention of this research that the improvements in injury outcomes demonstrate the efficacy of this MDT.

Table 1 – Team injury outcomes for 2017 and 2018 academy rugby league seasons.

	Number of injuries (N)	Incidence (/1000 h, 95%CI)	Severity (days)	Burden (days/1000 h)
2018 season	31	8, 5 to 11*	26 ± 24	205, 191 to 219**
2017 season	58	19, 14 to 24	27 ± 29	516, 491 to 542
League average	37	10, 8 to 12	25 ± 29	249, 240 to 258

* indicates a significant difference from the 2017 season ($p < 0.05$). # indicates a significant difference from league average

Participants

Four males and one female participant, aged between 25-36 years old ($M_{age} = 30.6$ years, $SD = 4.9$), were interviewed. All participants had significant experience within their respective professional roles in other environments ($M_{experience} = 6.1$ years, $SD = 2.6$, range = 3 – 10 years), but at the start of the 2018 season four of the five MDT members had less than 1 years' experience working in the academy.

Interview schedule

The interview guide was developed on the basis of a review of the relevant literature (e.g., (10, 20)) and informed by guidelines on qualitative research (26, 27). The interview guide consisted of four discreet sections, following recommendations for the structured-stage method of interviewing (26). The first section covered a short introduction to the aims of the study, a reiteration of the confidential nature of participation, and general demographics (e.g., age, gender). The second 'warm up' section aimed to build rapport (28), inviting the participants to narrate their background, their journey into and experience of working in professional sport as well as their current role. The third part of the interview focused on injury prevention processes and practices, comprising of three sections: (1) the injury prevention process within the club, (2) the role of each member of the MDT in relation to injury prevention, and (3) whether and how injury prevention could be

4

optimized. Follow-up questions were used to focus on how the process had come about, whether it had changed over time, who was involved, what each individual's role was perceived to be, how all those involved worked together and the perceived challenges of effective injury prevention. In the final 'cool down' section participants' views were summarised by the researcher as a check and challenge and participants were invited to add anything more that might have subsequently occurred to them. Throughout, probes and prompts were used to enhance the richness and depth of the contributions. These clarified responses, invited elaboration, elicited closer detail, while keeping the conversation on topic (26, 27, 29).

Data collection

Having received institutional ethical approval, participants were approached by email by the first author. Each participant was provided with an information sheet, given time to consider participation as well as an opportunity to ask questions. Upon indicating a willingness to take part, participants were provided with a summary of key questions prior to the interview so they could consider the focus and nature of the interview to increase the richness of data and detail provided (30, 31). Interviews were organized away from the club to ensure confidentiality. Prior to the start of the interview, it was stressed that participation was voluntary and that all the information they shared would remain anonymous. In addition, informed consent was obtained. All interviews were conducted face to face, lasting between 38 to 61 minutes ($Mtime = 47.4$ minutes, $SD = 9.7$). All interviews were recorded and subsequently transcribed verbatim.

Data analysis

Given the exploratory nature of this study, focusing on a novel, open-ended research question, inductive analysis of the data was deemed most appropriate (27). While acknowledging extensive familiarity with existing theory and research informed the study design and data-analysis, the inductive approach meant that no hypotheses were established in the initial phases of the research process. Further, the researchers explicitly took a bottom-up approach to data-analysis, aiming to establish meaning or theoretical understanding (about how this MDT made injury prevention work) based on patterns and relationships present in the data.

To achieve this, transcripts were analysed using established guidelines for inductive thematic analysis (32). This approach consisted of six phases, in the first phase the first author read, re-read and took notes allowing for familiarisation with the data. The first author then generated initial codes through open coding of each transcript, attaching descriptive labels to segments of relevant text. Phase three focused on the first author identifying themes through the grouping of codes according to similarity. This process resulted in an initial thematic map visualising sub-themes and higher order themes, as well

as the relationship between themes. This thematic map was then discussed in-depth with the second author. Phase 4 involved both authors reviewing each transcript against the codes, sub-themes and themes, going back and forth between the data and the emerging thematic map, ensuring there was sufficient support in the raw data for each theme and their interrelationships. As such, themes were triangulated amongst both team members (33) and did not only emerge from the data but also were shaped by these interpretative efforts (32). In Stage 5 and 6 of thematic analysis the findings were summarised in the final thematic map and the analytic narrative presented here. During this process, the names of themes and subthemes were identified.

Markers of quality

In terms of judging the quality of this study, a relativist, rather than criteriologist position (34, 35) is adopted. Instead of applying criteria in a universal manner for every qualitative study, a number of criteria aligned to the context, purpose and research design of the study are included (36). We therefore invite the reader to judge the quality of the work based on the following criteria: the worthiness of the topic; significant contribution (does the study contribute to new insights?); rich rigor (was the right sample selected? Has enough data been collected and presented for the findings and interpretations to be convincing? Are themes supported by appropriate direct quotations?); and the coherence of the research (Do the study design and reported results align to the study purpose? Are the findings investigated against existing theories and previous research?) (37). Further, the study also aims for resonance; do the findings make sense to the reader, can the reader see how they could be useful? (38) In order to enhance the quality of the work, the second author acted as a critical friend throughout the research process. By not collecting the data and only becoming engaged with the analysis once the first author had analysed all the data, she was able to listen to the first authors initial interpretations and proposed explanations, evolving to a critical dialogue giving voice to multiple interpretations. Such peer debriefing is not conducted to reach consensus but to increase reflexivity and challenge interpretations (35).

Results

The results of this qualitative investigation depict the reported working practices, relationship dynamics and contextual conditions experienced by professionals working as part of a successful professional sport MDT. Three inter-related themes emerged; 1) shared values, 2) expertise and 3) the effective operationalization of underpinning values and expertise, which were identified as the key constructs explaining effective MDT working in this context. The thematic map is presented within figure 1, with further detailed explanation of each of the respective themes below.

1. Shared Values

It was evident from the thematic analysis that a shared value system existed between all members of the MDT. This value system provided a deep-rooted understanding of the overarching principles that the group should uphold in their daily practice. The following values were acknowledged among the whole team as cornerstone principles of practice. Selected quotes from within the interviews are provided in Table 2 to substantiate the value statements below.

Figure 1 – Thematic map of the emergent themes and sub-themes that characterized the working processes of an effective multidisciplinary team.

Future performance is driven by healthy performers

There was a universal acknowledgement that the academy represents a developmental environment, and as such winning is not the most important thing. Instead, emphasis was placed on the development of personal, physical and skill attributes that would stand players in good stead in their future careers. This value was supported by a conceptual understanding that there is no clear differentiation between athletic development and injury prevention. On this understanding, if training was appropriately prescribed according to the individual needs of the players, the risk of injury would be relatively low. As a result, a huge emphasis was placed on collaborative planning of appropriate training.

Collective responsibility

Among the MDT members there was a clear understanding that injury prevention is everyone's job. While each MDT member had a clearly defined role based on their area of professional expertise, there was evidence of co-operation and collaboration in all areas of planning. For example, coaches were highly conscious of ensuring that the physical loads players were subjected to in training sessions were aligned with a clear periodised plan as recommended by the S&C coach and sports scientist to ensure appropriate progression. Further, the coaches were highly supportive of any efforts by the other MDT members to improve player behaviours linked to injury risk.

All expertise is valued – environment of mutual respect

Within the MDT all members were recognized by their colleagues as experts within their own field and for the contribution that they can make to overall team performance. MDT members were trusted to act in the best interests of the players and as such their ideas were always taken seriously. This provided a situation where all members could act within an environment of psychological safety with no fear of being attacked if their professionally informed view was at odds with the rest of the MDT.

Continuous desire to improve

Despite acknowledging many things were working well, all members of the MDT also displayed a dissatisfaction with the current status quo and therefore aimed to improve practice across the organization. This desire for continuous improvement was an important ingredient for developing practice within the MDT. MDT members displayed a willingness to critique their own practice, and continually assess where both their own practice and the academy system as a whole could be improved. Within the environment of mutual respect that had been fostered, a critical-friend culture developed where colleagues were able to check and challenge each other's practice while maintaining trust. This created a healthy tension where MDT members were trusted to do the best job possible, but could also actively and continually review individual and group functions to ensure best practice within the environment.

Table 2. Quotes defining/describing core values at work within the academy.

Core Value	Quotes
1. Future performance is driven by healthy performers	<p><u>Prioritizing player health</u></p> <p><i>"I think that's more like the bigger picture from everyone. ... Coach has been very good this year as in "Let's not rush them, let's just rest if it's better for him" so he's always been about looking after the player rather than what's best for the team, because obviously it's great to win, get to the Grand Final and it would have been great to win the Grand Final but that's not what he's there for at the end of the day."</i> Sport Scientist</p> <p><i>"I think as a Sports Science Medical Team we are allowed to implement stuff because winning is not the number one priority, it's developing players."</i> Physiotherapist</p> <p><i>"We have a duty of care as a Department to make sure we get the best out of our players."</i> Assistant Coach</p> <p><i>"We go through the debate and have to remind ourselves sometimes that we are not there to get them ready for the match play on Saturday, we are there to prevent them from long term injuries and keep them fit to play Super League."</i> Sport Scientist</p> <p><u>Physical development and injury prevention are aligned through appropriate training</u></p> <p><i>"Within the perspective of performance and injury prevention can coincide is how we try to align that as much as possible. So, from a perspective of if we want the players to have a certain level of tolerance, the high-speed running or sprinting we ensure that we do plenty of sprinting to accommodate for that, but also hopefully get performance adaptations from that."</i> Strength and conditioning coach</p> <p><i>"So, that's our main goal whereas the players it's obviously on the field winning games and if we can like I say educate them a little bit more about being on the field and staying on the field, being strong, being fit and not having injuries we'll add to that chance of winning."</i> Physiotherapist</p>
2. Collective responsibility	<p><i>"I'll ask her what we need to cover this week and we'll factor our sessions in around them."</i> Head Coach</p> <p><i>"So, to prevent injury so, for instance, they came back to training on Tuesday did our players and we were encouraged to cover limited distances due to the testing they were doing. We bought into that."</i> Assistant coach</p> <p><i>"At the first training session the Coach spoke about standards and that created a precedent, I think, for the season to the players and part of those standards were prehab. Part of those standards were regular appointments with Physio. Part of those standards were rehab, prehab and so and so forth and if the standards were not met questions were asked in the best manner because they are young men and they are going to make mistakes."</i> Assistant coach</p> <p><i>"Hopefully it should come as an MDT approach. So, we're taking it from the individual silos which we have as roles within the group and where possible trying to develop that sort of into disciplinary practice"</i> Strength and conditioning coach</p>

	<p><i>"I think every member of the team, we're working towards the same goals and I think that's key, everything is really well streamlined. I think it works really well."</i> Physiotherapist</p> <p><i>"It isn't the Physio's sole responsibility to prevent injury. It's our responsibility as a Department to prevent injury and we all tip into that"</i> Assistant coach</p>
3. All expertise is valued	<p><i>"For a team to be successful all members of staff have to communicate well and have a good relationship with everybody so with our sport scientist, I ask what we should cover. I genuinely want what's best for people. I'm never going to overrule her."</i> Head Coach</p> <p><i>"If the Physio reports to me I always say to Physio whatever you think because that's his field. I would never say no. He's going to do this running today although he is reporting a tight hamstring or whatever. I would never over rule him because I don't ever want to be put in that position so I trust the Physio to make that call. There is a fine line between being a bit soft and wanting to not do it as opposed to risk an injury. I trust the Physio and I trust the medical staff 100% to make a decision. I don't put any pressure on them to play players at all."</i> Head Coach</p> <p><i>"We respect them. We understand them"</i> Assistant coach</p> <p><i>"I've worked with the Head Coach, and the Assistant Coach and they'll take it as gospel what we think"</i> Physiotherapist</p> <p><i>"They buy into it a lot, the GPS and that so they kind of just trust me and let me get on with it really."</i> Sport Scientist</p>
4. Continuous improvement	<p><u>Desire for continuous improvement</u></p> <p><i>"The good thing about the club and also the individuals in the academy is we're all striving to excel and really improve the product"</i> Assistant Coach</p> <p><i>"I'm learning and picking stuff up, I'll just look at the similarities from the previous year to this year and I'd incorporate that into my coaching again because I'm probably five, six, 10 years off being the best Coach I could ever be."</i> Head coach</p> <p><i>"So, everyone as part of their, we have like basically some sort of reflection, self-appraisal, what they felt could be improved within the system and one of the things was communication... so that was kind of pushed!"</i> Strength and conditioning coach</p> <p><i>"I guess it's having those discussions and formalising those discussions with the Coach, the coaching staff and the team members and, you know, ironing out why do we think we did get less injuries and keeping those things in place but then saying "How can we further reduce their injuries going into next year?"</i> Physiotherapist</p> <p><i>"I think there was probably an instance, it was probably the S&C staff who probably got it wrong and they admitted it. From experience I think they probably learnt that they probably need to look at when they do this phase or whatever it was"</i> Head coach</p> <p><i>"We had like a mid-season review and in that I compared ... our volume and that compared to the season before so we could see how we were going compared to that. It was more at the mid-point, this is what we're doing, we're doing this better, well we think better, it's the training loads generally higher and it's better than it was last year basically."</i> Sport scientist</p> <p><u>Safe space to check and challenge</u></p> <p><i>"The fascinating thing about it is we question in the best manner, she obviously feed backs to us in the best manner, there's no friction there."</i> Assistant coach</p>

*"Everybody has an opinion in meetings and I suppose what I'm saying here is all staff members whether you're a PhD student or a qualified coach, or even a volunteer you're valued and I think that's massive. Your opinion is valued. We've created an environment now where staff can openly speak to me as a Coach, or *** as Head Coach, and question what we do in the best manner. It's very respectful. That's opened doors for conversation and debate to happen and from that type of debate and conversation it has helped the bigger picture."* **Assistant coach**

"There are a few times we have to sort of come up with an alternative sometimes but nothing much. It's pretty good. They'll give their point of view, we'll give our point of view and overall obviously I'll get the main decision but it's pretty rare that we ever over rule anybody or anything like that because they are experts in their field and I'm keen for them to do their job right" **Head Coach**

2. Expertise

Excellence in areas of professional expertise

The members of the MDT all possessed impressive credentials in terms of their experience and domain specific knowledge (Table 3). It was also evident that most MDT members had had a broad range of professional experiences which may have improved their understanding of the expertise required to perform others' role.

Contextual expertise – applying knowledge within the environment

Despite being both well qualified and experienced, all MDT members discussed how it was necessary to develop an understanding of the environment and to tailor their practices in order to be effective under those conditions. As such, efficacy of MDT members practice improved as a function of time spent in the environment (Table 3).

Interpersonal expertise

A further theme that emerged from interviews was that it was not sufficient to simply be good at your job and understand how to do your job well within the environment. In addition to this, relationships with other MDT members needed to be fostered. It was a prominent feature of the interview process that all reported MDT interactions were conducted within a climate of mutual respect. Further, it was clear that MDT members gave consideration to how best to communicate messages to ensure that they were correctly interpreted and understood by other MDT members. This empathetic approach to communication likely contributed to the environment of psychological safety that was created that allowed MDT members to both collaborate effectively and challenge each other's practice without fear of reprisal.

Table 3. Information and quotes defining the expertise present in the multidisciplinary team in terms of professional qualifications, experience, and contextual understanding

Indicators of Expertise	Information source		
1. Excellence in areas of professional expertise		Qualifications	Professional experience
	Head Coach	<ul style="list-style-type: none"> ▪ Bachelor degree in Sport Science ▪ Level 2 Rugby League Coach (RFL) 	<ul style="list-style-type: none"> ▪ Professional rugby league player for >15 years with significant success. ▪ International representative ▪ Five years coaching experience
	Assistant coach	<ul style="list-style-type: none"> ▪ Bachelor degree in Coaching Studies ▪ Level 3 Rugby League Coach (RFL) 	<ul style="list-style-type: none"> ▪ 19 years experience as an academy rugby league coach ▪ Former academy and professional rugby league player.
	S&C coach	<ul style="list-style-type: none"> ▪ Bachelor degree in Sport and Exercise Science ▪ Masters degree in Strength and Conditioning ▪ Enrolled on a PhD programme 	<ul style="list-style-type: none"> ▪ 5 years experience as an S&C coach working across multiple sports ▪ Competed at representative level in both athletics and judo.
	Sport Scientist	<ul style="list-style-type: none"> ▪ Bachelor degree in Sport and Exercise Science ▪ Masters degree in Sport and Exercise Physiology ▪ Enrolled on a PhD programme 	<ul style="list-style-type: none"> ▪ Three years working as a sports scientist within professional sport. ▪ Five years working as a youth sports coach ▪ Two years as a strength and conditioning coach
2. Context specific expertise	Physiotherapist	<ul style="list-style-type: none"> ▪ Bachelor degree in Sport and Exercise Science ▪ Post-graduate certifications in Physiotherapy and Manual Therapy 	<ul style="list-style-type: none"> ▪ Seven years working experience in the national health service, professional academies and senior professional clubs. ▪ Former Head of Sport Science and Medicine for a football academy
	<i>"So, for example, today we're doing 2k. We will do a session which facilitates 2k. That took six months for me as to what sort of drills contribute to what distance and things like that but I've got that now."</i> Head coach		

	<p><i>"I'd say it's evolved towards that. Staff members have become better at their job which it sounds a little bit weird saying that but that comes from experience. So, am I a better Coach than I was three years ago when I started full time? Hell, yeah. Is (Sport Scientist) better at her job than what she was when she first started? Yes. Is (S&C Coach) the same? Yes. Is (Physiotherapist) exactly the same? Yes. Is (Head Coach) a far better Coach than he was? Yes"</i> Assistant Coach</p> <p><i>"The understanding of the coaching staff for training load from a skills, positional extras, combat side is massively improved... their understanding of what a high speed running session, accel, decel and more of a longer running session should look like...."</i> Strength and conditioning coach</p> <p><i>"I came in as an extra role, I wasn't replacing anyone, so it allowed more time to be placed upon it. The GPS was new when I started so that was all new to the Coaches so I've kind of developed, I started basic with them and then we've tried to add stuff, educate them more and have more things feeding back to them."</i> Sport scientist</p>
3. Interpersonal skills	<p><i>"An issue last year was, and again this is probably through inexperience of me, is that at times we probably looked after them a bit too much in the sense of if that was meant to be a 2k day we would never go over it, we would stick to it whilst in the end it probably created a mentally soft bunch. We'd probably not be as black and white with it (now). If we've still got a bit to do and they've trained poor then we'll do a bit longer. So, we use it more as a guideline rather than a set thing."</i> Head coach</p> <p><i>"Myself and (Head coach) work hand in hand with each other. This season it worked slightly different. He gave me an area to look after which was defence. He looked after the offence and then we married the two together. He had an opinion on the defence, I had an opinion on the offence and we've built a real good partnership over the last 12 months I think."</i> Assistant coach</p> <p><i>"So on both sides, we have to ensure that we're using appropriate language that we all understand as a collective, so whether that's changing some of our language from their perspective, so if they use certain key terms or phrases ensuring that the rest of our group does that, but then the other side ensuring that they understand what we're doing to be able to make actions on that so potentially using it as much in their language but also trying to up skill at the same time."</i> Strength and conditioning coach</p> <p><i>"At the beginning of the season I wasn't feeding back high speed running to them, I was looking at it myself, I wasn't feeding it back and then I learnt more like what they wanted so I started feeding that back more and then we kind of ended up with, so I started giving them targets of, so the target is 3km but we want it to be a high speed running session so your target is 15% of that to be high speed running so it was just a learning curve for me and from what they could respond to I think."</i> Sport scientist</p> <p><i>"We're better as a Department. I know keep saying this. So, staff communicate better. Why? Because they are more comfortable in the environment."</i> Assistant coach</p>

3. Operationalisation

The previous sections have described the shared value system and expertise present within the MDT that are crucial underpinning factors for the success of the team. Within this context the following section aims to describe the operational processes that the MDT engages in, as well as the organizational and structural factors that support these processes.

Monitoring and evaluation

Within the academy, a sophisticated data collection system exists where training loads, and player responses to these loads are continuously evaluated over differing time frames. Table 4 details the academy player monitoring process. In addition to formal data collection procedures, players are under continuous observation by MDT members, and reflections from these observations also provide valuable information. This process provides a rich body of data to inform professional decision-making.

Table 4. Data collected as part of the academy player monitoring and training evaluation process.

Data source	Frequency of collection	Reporting structure
<u>Pre-season Screening</u> <ul style="list-style-type: none">• Previous injuries• Adductor strength• Sit and reach• Knee to wall	Once during preseason	Used to develop individual prehabilitation plans and to inform the content of warm ups. Modification of S&C training if required
<u>Daily Screening</u> <ul style="list-style-type: none">• Wellness questionnaire• Sit and reach test• Adductor squeeze test	3x per week	Immediate report to coach prior to training if any adverse results are present
<u>Training Load</u> <ul style="list-style-type: none">• session RPE• GPS<ul style="list-style-type: none">- Total distance- High speed distance- Relative distance (m/min)- Accelerations- Decelerations	Daily	Session report emailed to MDT members following each training session.
<u>Injury surveillance</u> <ul style="list-style-type: none">• Incidence and severity of time-loss injuries• Prevalence of non-time loss injuries	Daily	<ul style="list-style-type: none">- Informal discussions- Weekly injury report within formal MDT meetings- Modification of training programs to manage non-time loss injuries- Annual summary report for end of season review

Plan, do, review process

Aligned to the value of future performance is driven by healthy performers, great care is taken to plan training to provide appropriate training to ensure continued physical development while limiting fatigue and injury. This is facilitated through a process of collaborative planning within the MDT and then the use of monitoring data to 1) ensure that planned loads and intensities are achieved, and 2) to monitor individual response to these loads. Where players display symptoms of maladaptation, training is adjusted in response. MDT members noted that these types of adjustments were infrequent, reflecting that in most cases the training exposures were appropriate. The ongoing process of planning appropriate training, measuring training outputs, and then reviewing these against the planned loads allowed for frequent 'course correction' ensuring that training exposures remain aligned to the expertise informed training plans.

Space, time and structure for communication

Aligned to the value of "All expertise is valued", clear structures have been put in place to ensure that essential communication between all MDT members takes place regularly. Specifically, a weekly MDT meeting is scheduled at the commencement of each week (Table 4). The purpose of this meeting is to discuss the weekly microcycle and how sessions will align to longer term outcomes, but also provides an opportunity for all MDT members to discuss any concerns that have arisen over the previous week. All MDT members recognized the importance of this meeting for collaborative planning and reflection. One MDT member noted that the MDT had placed increased importance on these meetings following the season when their injury outcomes were poor. One of the perceived reasons for the high injury burden in 2017 was poor communication among the MDT.

In addition to these formalized meetings, huge amounts of information were shared via informal "check-ins" and corridor conversations. MDT members ensured that they arrived early enough prior to training sessions to ensure time for these informal conversations to take place. Further, the layout of the work space was conducive to facilitating these types of discussions. The physiotherapist, sport scientist and strength and conditioning coach shared an open plan workspace that the coaches had to walk through to access their office. Even when coaches were in their office the door was always open and conversations continued between coaches and other MDT members. In cases where the physical structure of the workspace did not allow for these opportunistic discussions to take place, MDT members reported deliberate efforts to find and engage with other MDT members. In addition, MDT members also used a range of remote communication methods including WhatsApp and email. On the whole, communication between MDT members was pervasive.

Another important feature of the communication system was that it was a flat, non-hierarchical system where all MDT members had direct access to players and to each other (figure 2). While it was evident that the head coach and assistant coach were leaders within the MDT and that the responsibility for decision making ultimately rested with them, they actively included, encouraged and supported the inputs of all MDT members.

Figure 2 – Player centered organizational structure adopted by an effective multidisciplinary team working in professional sport.

Overall, members of the MDT reported being highly satisfied with the interpersonal climate and working constraints within which the MDT operated, as demonstrated by the quotes below.

“I think from previous years the reason why I think we’re in a better place is because of us as staff. Us, as staff, have gelled better than I’ve ever known” **Assistant coach**

“Certainly the academy structure is the best I’ve been in. I wouldn’t change anything to be honest. I think every member of the team, we’re working towards the same goals and I think that’s key, everything is really well streamlined. I think it works really well.”

Physiotherapist

Table 5. Information and quotes defining the operational principles and procedures adopted by the multidisciplinary team

Operational principles	Quotes
1. Monitoring and evaluating training	See table 4
2. Plan, Do, Review	<p><i>"I've put in a skeleton structure to try and have a long term training plan for the coaches have as a framework to work from so that we can moderate training volume and intensity to match, one for the adaptations that we want, but also that we're not potentially overloading in certain areas that might put us at more risk or above a risk that deem as acceptable."</i> Strength and Conditioning Coach</p> <p><i>"So, we sat down the other week and we kind of planned a structure of what days will be hard and what days will be easy and then the gradual increase of weeks not only for the overall load but for high speed running, acceleration, deceleration, so the mechanical and muscular load as well over that. So, that is kind of the basic structure."</i> Sport Scientist</p> <p><i>"So periodisation, so an example of this we had a light week so we liaise with our Sport Scientist and she'll kind of tell us what we should be doing all with a view and focus on doing what's best for the player and preventing injury. So, our training is set around injury prevention. We'll have a 12k for the first week for example and we'll filter that in throughout the week and do what's best."</i> Head coach</p> <p><i>"I mainly feedback, so we have a discussion at the end, so after every session I send a report to the coaches so they always know what we're doing, what we plan to do compared to what we did do."</i> Sport Scientist</p> <p><i>"So, (Sport Scientist) gets a red flag through the monitoring system and suggests that we potentially need to moderate training, what we typically do is more often reduce volume as opposed to intensity"</i> Strength and Conditioning Coach</p>
3. Time, space and structure for communication	<p><u>Formal communication structures</u></p> <p><i>"We always meet up at the start of the week to plan the week's training. We discuss the outlook of the week and we also discuss the previous week generally... So, for instance, GPS will be discussed, injury prevention will be discussed, S&C will be discussed and also from a coaching perspective what we want to do and then obviously any other business comes into that."</i> Assistant Coach</p> <p><i>"So, when I very first started it was kind of as and when the Coaching technical tactical staff thought was appropriate, then we had our yearly reviews and I said that it potentially wasn't to what it should be and what I discussed was that there was a minimum that we meet for one hour weekly to be able to discuss that because no-one knows what's happening if we're not communicating."</i> Strength and conditioning coach</p>

Informal communication

"We have informal meeting on a day to day basis and we are literally a few yards away from each other so if anything needs to be brought up we are constantly communicating and that happens in that 12 until 4 o'clock block before the players come in."

Head coach

"Typically if there is anything that needs discussing just before the daily as opposed to the weekly it's typically 20 minutes beforehand to catch up and making sure I'm clear on what that training session looks like, ensuring that still aligns to the big skeleton structure." **Strength and Conditioning Coach**

"We work very closely together. So as soon as we get in we'll have, again it would be an informal chat but we make sure we do catch up first thing to discuss any issues with any players, any new issues we need to be aware of and try and iron them out. I try and then go to the coaches and again inform them of anything that is new in terms of players that might be missing from training or anything they need to be aware of." **Physiotherapist**

"Whether that's from short meetings. Whether that's a long bus journey or whether it's a formalised meeting for whatever reason those are the kind of key opportunities when we get to communicate, or through WhatsApp which is the other one we use." **Strength and conditioning coach**

Flat communication structure

"Our physio on a regular basis comes up into the coaching department and we have discussions. Us, as coaches, on a regular basis go down into the physio department and have regular catch ups and discussions." **Assistant Coach**

"Every session when I arrive I'll see what the coaches have planned for their session and I'll feed in, because we put on a document which we all have access to, what distance is planned and what intensity is planned but then I'll reinforce and chat about that with the Coaches. I also then try and speak to (Physiotherapist) to see if there is anyone modified because then if we modifying them I try and speak to the coaches and ask what parts of the session they want them involved in."

Sport Scientist

Discussion

The aim of this research was to examine the working practices of a demonstrably effective MDT working in a professional sport setting in order to provide information on the attitudes, behaviours and ways of working that facilitated the team's success. MDTs have become ubiquitous in professional sport, but the characteristics of successful MDTs in these environments are not readily identified. The information provided by this study should be used to inform stakeholders about facilitators and obstacles to effective multidisciplinary teamworking in the high-pressure environment of professional sport. The main finding of this research is that while effective operational procedures are undoubtedly important, the effectiveness of these procedures is built on a foundation of shared values and high levels of professional and interpersonal expertise.

The findings presented here align with a number of previously presented theoretical assertions regarding the requirements for effective MDT working. It has been proposed that MDT's are likely to function best when all members are working towards clearly stated, well-defined and mutually agreed, shared goals (10, 20). In the current study this aligned purpose was demonstrated when all MDT members acknowledged the same goal – developing healthy performers with the personal, physical and skill attributes that would stand players in good stead in their future careers.

A further proposed prerequisite for effective MDT team working is functional team dynamics (10, 20). It is generally accepted within social sciences that conflict is necessary for the development and evolution of group dynamics, however this can often make people feel uncomfortable or threatened (39). The heterogeneous composition of MDTs will inevitably cause conflict due to the differing lenses that team members use to understand and interpret problems. Effective working within such an environment requires team members to display tolerance in embracing alternative perspectives, trust in each other's competencies, be willing to share roles and responsibilities and generally behave in a mutually respectful manner (10). All of these principles of behaviour were clearly apparent in the MDT. These aspects of behavior have previously been described in other high functioning professional sports teams (40).

While the principles of shared goals and mutual respect are clearly important for effective MDT processes, the presence of these characteristics do not fully describe the working dynamic present within the MDT group examined. Underpinning these goals and behaviours was a powerful group dynamic with all group members passionately committed to continual improvement and shared responsibility in achieving the collective goals. The desire for continuous improvement was pervasive and was demonstrated on both an individual and team level. This personal and collective commitment to improvement allowed for the healthy tension to exist between trusting the expert opinion of MDT members in their area of expertise while also being able to check and challenge each MDT member's

practice. This dichotomy could only exist in an environment where each team member actively seeks improvement and thus embraces criticism as a useful mechanism for improvement.

The emergence of such an environment is likely to relate back to the quality of the team dynamics. In order for these criticisms to be expressed and accepted as constructive, the interpersonal climate needs to be, and in the current study arguably was, characterized by psychological safety. Team psychological safety includes but extends beyond respect and has been defined as: “a shared belief that the team is safe for interpersonal risk taking” (41). In a psychologically safe climate team members think they will not be embarrassed, thought less of, or disciplined when they speak up, challenge prevailing opinions or express their thoughts truthfully (42). Open and honest communication is possible because people are less focused on protecting their image (43). Previous research with multidisciplinary healthcare teams has shown how increased team psychological safety is an important catalyst in enhancing understanding and power sharing across professional boundaries and thus in the development of interprofessional teamwork (44), increasing creative performance (45) and engagement with quality improvement and team learning (46). The current findings support this in highlighting a strong drive for innovation in the MDT.

It is clear from the analysis above that the success of the MDT examined here was grounded in having likeminded individuals working in alignment within a conducive working environment. What is unclear from the current research is how likeminded approach emerged. Previous researchers proposed that MDT members need to agree goals that are personally meaningful to group members (47). In this study, while agreement within the MDT on shared values was universal, no MDT member described a formal process via which these values were decided upon. Similarly, all MDT members displayed ongoing and concerted efforts towards continuous improvement, but there was no evidence of formal thought or planning given to creating these conditions. It is appealing to think that these shared values and attitudes were emergent in this group, but we should consider what conditions allowed this situation to emerge. Research has demonstrated that environments conducive to continuous improvement result from 1) commitment from team leaders to organizational goals, 2) empowered work teams with open communication structures, and 3) increased worker involvement in design and planning, and greater autonomy in decision-making (48), all of which were present in the current study. As such it can be argued that the conditions that promoted the development of the shared value system were the result of the interactions between the people within that system.

Therefore we must question why this collection of individuals was able to develop such high levels of synchronicity in their approach to their work. One possibility is that these staff were recruited because they displayed similar attitudes and values to established staff and would therefore be a good ‘fit’ within the environment. Similarly, it is also possible that individuals that have the attitudes and skillsets to be effective in this environment are attracted to working within these types of structures. A second plausible explanation is that due to their high levels of experience and interpersonal expertise,

MDT members were able to modify their behaviours to align with the group, in the knowledge that this would make the group more effective. Finally, the influence of effective leadership within this environment should not be underestimated. As the de facto leaders of the MDT the coaches displayed elements of both transformational and altruistic leadership which have both been described as factors that contribute to MDT cohesion (49, 50). Leadership has also been implicated as an important component of injury prevention in professional football clubs where teams with coaches that communicated a clear and positive vision, and adequately supported staff members had much lower incidences of severe injuries (51).

In addition, although possibly inadvertent, the leaders in this group adopted a number of the principles of agile management including 1) supporting, trusting and motivating the people involved; 2) allowing teams to self-organise to improve product designs; and 3) regular reflection of how to become more effective (52). Notably, the agile management approach promotes the philosophy that empowering skilled and motivated team members with decision-making authority, causes them to take ownership, communicate regularly with other team members, and share ideas that deliver quality products (52). These outcomes were clearly apparent in the current study.

It should be noted that while high levels of congruency in MDT member attitudes and values, conducive leadership traits and management approaches were observed, this research study was designed to examine the prevailing characteristics of this team, not to determine how these characteristics emerged. As such, questions around leadership and management styles and how values were agreed or emerged were not contained within the interviews and it would be valuable to explore this process in future research.

Communication emerged as an important theme within the analysis of the MDT working practices. Indeed, previous research demonstrated that severe injuries were more common in professional football teams with poorer communication levels (53), indicating that effective communication structures are essential for MDT function. In terms of what effective communication looks like, Roncalgia (2016) previously proposed that MDTs require a clear understanding of what information must be shared by who and in what timeframe (54). Equally, high levels of conscientiousness with regard to communication contributes to the construction of effective interpersonal relationships (55). In the present study, MDT members displayed considerable efforts to communicate their messages in a manner that would be easily understood by other MDT members, and were highly conscious of using both formal and informal meeting opportunities to communicate which likely contributed to team effectiveness.

The communication structure observed in this study is in direct contrast with those that have previously been suggested for MDTs working in professional sport (7, 11). Within these suggested structures, the position of 'performance director' or 'performance support team lead' has been

designated as an intermediary between the coach and athlete(s) and the sport science and medicine team, communicating with the various support staff as and when required. A potential consequence of this type of organizational structure is that it could isolate MDT members and lead to interdisciplinary competition for attention from the coach or performance director (20). In the current study, although the team did have a 'head of science' as part of the larger operational structure, he was not involved in the day-to-day operations of the MDT. Further, and partly as a result of this, the MDT adopted a 'flat', non-hierarchical structure (Figure 2). Within this structure all team members frequently communicated with all other MDT members. It is plausible that this openly communicative team structure contributed to the emergence of the shared value system observed within the MDT. Further it is likely that this frequent communication and involvement in decision making contributed to the development of close (affective) connections between MDT members (55). This may have contributed to the team performance, as it has been previously observed that teams perform better when MDT members attach emotional importance to their team membership (56).

In addition to effective communication structures, in the present study, the MDT was also operationalized through an effective shared working model. Within MDTs there is often ambiguity and interdependence in the roles of different professionals (20). In order to work effectively, agreement needs to be attained regarding what will be done, when it will be done and by who, especially where areas of professional overlap exist (10). This formalization of roles provides team structure, behavioural norms and scripts that operationalize how the team coordinates its efforts facilitating collaboration (57). The MDT operationalized themselves using a plan-do-review structure where player and team progression was ensured by constantly reviewing progress towards team performance outcomes. This process was very well resourced in terms of availability of staff and the quality and breadth of data that could be collected to inform decisions. Research into medical MDTs has found that "considerable organisation, management infrastructure and funding" are required in order for teams to work effectively (58), and this was certainly the case in this study. Providing MDTs the opportunity to function optimally requires that these teams are adequately staffed (with professionals representing the professional knowledge areas required), and that these staff are provided with adequate time and space to communicate regularly and effectively (55).

While it is likely that the findings of this study can be extrapolated to other MDT environments, it is important to acknowledge some of the limitations of the current study. Firstly, it is difficult to identify high-performing or effective MDTs due to the complex nature of sports performance. In the current study, it was apparent that the MDT in question represented an injury prevention "bright spot" (*an observable exception that produces results above the norm with only the same kinds of resource (59)*) within the league and was therefore purposefully sampled. However, this type of case study research design is limited because it is not possible to verify the findings within a larger sample as similarly performing MDTs are not available for investigation. Further, in the present study, effectiveness was identified by objectively evaluating injury outcomes. Improved injury outcomes have

been regularly associated with improved sports performance (60), however it should be noted that performance could feasibly be evaluated using a range of other criteria including actual results or the physical and mental wellness of the academy players (61). A factor that may limit the translation of this research to other professional sport environments is that the MDT study here was embedded within an academy rather than a 'performance' team. The current investigation revealed that all MDT members identified that they were working in a developmental environment and as such sporting results were not the most important outcome. It is possible that in performance settings the focus on results could conflict with the principle focusing on the future through the development of healthy players now, however these two goals are not inherently exclusive (21).

Conclusion

This research aimed to describe the attitudes, behaviours and ways of working that characterized a highly effective MDT. The team examined was in a fortuitous position in that it was staffed by individuals with high levels of professional expertise, and the team was well resourced both in terms of capacity to collect relevant data and time to plan, review and communicate. While there can be no doubt that these factors contributed to team success, it should also be noted that the presence of experts and availability of resource does not guarantee MDT effectiveness. In the present study, the practice of the MDT was underpinned a universally shared value system and frequent, effective and empathetic communication within a flat and psychologically safe communication structure. The implication of this is that communication structures and leadership styles should be aligned to support inclusive and effective engagement of all MDT members.

Contributions

Contributed to conception and design: JCT, FR

Contributed to acquisition of data: JCT

Contributed to analysis and interpretation of data: JCT, FR

Drafted and/or revised the article: JCT, FR

Approved the submitted version for publication: JCT, FR

Acknowledgements

N/A

Funding information

No funding was in support of this project was received by either author.

Data and Supplementary Material Accessibility

No supplementary material available. Sharing of interview transcripts risks compromising the anonymity of the study participants.

REFERENCES

1. Meeuwisse WH, Tyreman H, Hagel B, Emery C. A dynamic model of etiology in sport injury: the recursive nature of risk and causation. *Clin J Sport Med*. 2007;17(3):215-9.
2. Bittencourt NFN, Meeuwisse WH, Mendonça LD, Nettel-Aguirre A, Ocarino JM, Fonseca ST. Complex systems approach for sports injuries: moving from risk factor identification to injury pattern recognition-narrative review and new concept. *Br J Sports Med*. 2016.
3. Bekker S, Clark AM. Bringing complexity to sports injury prevention research: from simplification to explanation. *Br J Sports Med*. 2016;50(24):1489-90.
4. Bolling C, van Mechelen W, Pasman HR, Verhagen E. Context Matters: Revisiting the First Step of the 'Sequence of Prevention' of Sports Injuries. *Sports Med*. 2018.
5. Chalmers DJ. Injury prevention in sport: not yet part of the game? *Injury Prevention*. 2002;8 (Suppl IV):iv22-iv5.
6. Tee JC, Bekker S, Collins R, Klingbiel J, van Rooyen I, van Wyk D, et al. The efficacy of an iterative "sequence of prevention" approach to injury prevention by a multidisciplinary team in professional rugby union. *J Sci Med Sport*. 2018;21(9):899-904.
7. Dijkstra HP, Pollock N, Chakraverty R, Alonso JM. Managing the health of the elite athlete: a new integrated performance health management and coaching model. *Br J Sports Med*. 2014;48(7):523-31.
8. McCunn R, Gibson NV, Fullagar HH, Harper LD. Professional youth football academy injury data: collection procedures, perceived value, and use. *Science and Medicine in Football*. 2017.
9. McCall A, Carling C, Nedelec M, Davison M, Le Gall F, Berthoin S, et al. Risk factors, testing and preventative strategies for non-contact injuries in professional football: current perceptions and practices of 44 teams from various premier leagues. *British journal of sports medicine*. 2014;bjsports-2014.
10. Roncaglia I. A practitioner's perspective of multidisciplinary teams: Analysis of potential barriers and key factors for success. *Psychological Thought*. 2016;9(1):15-23.
11. Sporer BC, Windt J. Integrated performance support: facilitating effective and collaborative performance teams. *Br J Sports Med*. 2018;52(16):1014-5.
12. Coory M, Gkolia P, Yang IA, Bowman RV, Fong KM. Systematic review of multidisciplinary teams in the management of lung cancer. *Lung Cancer*. 2008;60(1):14-21.
13. Kesson EM, Allardice GM, George WD, Burns HJG, Morrison DS. Effects of multidisciplinary team working on breast cancer survival: retrospective, comparative, interventional cohort study of 13 722 women. *BMJ*. 2012;344:e2718.
14. Monaghan J, Channell K, McDowell D, Sharma AK. Improving patient and carer communication, multidisciplinary team working and goal-setting in stroke rehabilitation. *Clin Rehabil*. 2005;19(2):194-9.

15. Eller AG, Bennett MA, Sharshiner M, Masheter C, Soisson AP, Dodson M, et al. Maternal Morbidity in Cases of Placenta Accreta Managed by a Multidisciplinary Care Team Compared With Standard Obstetric Care. *Obstetrics & Gynecology*. 2011;117(2):331.
16. Gabel M, Hilton NE, Nathanson SD. Multidisciplinary breast cancer clinics. Do they work? *Cancer*. 1997;79(12):2380-4.
17. Davies AR, Deans DAC, Penman I, Plevris JN, Fletcher J, Wall L, et al. The multidisciplinary team meeting improves staging accuracy and treatment selection for gastro-esophageal cancer. *Dis Esophagus*. 2006;19(6):496-503.
18. Boxer MM, Vinod SK, Shafiq J, Duggan KJ. Do multidisciplinary team meetings make a difference in the management of lung cancer? *Cancer*. 2011;117(22):5112-20.
19. Elphinston J, Hardman SL. Effect of an integrated functional stability program on injury rates in an international netball squad. *J Sci Med Sport*. 2006;9(1-2):169-76.
20. Reid C, Stewart E, Thorne G. Multidisciplinary Sport Science Teams in Elite Sport: Comprehensive Servicing or Conflict and Confusion? *The Sport Psychologist*. 2004;18.
21. Gabbett TJ, Whiteley R. Two Training-Load Paradoxes: Can We Work Harder and Smarter, Can Physical Preparation and Medical Be Teammates? *Int J Sports Physiol Perform*. 2017;12(Suppl 2):S250-S4.
22. National Service Framework Assessments No. 1: NHS cancer care in England and Wales. London: Commission for Health Improvement; 2001.
23. Tee JC, Till K, Jones B. Incidence and characteristics of injury in under-19 academy level rugby league match play: A single season prospective cohort study. *J Sports Sci*. 2019;37(10):1181-8.
24. Knowles SB, Marshall SW, Guskiewicz KM. Issues in estimating risks and rates in sports injury research. *Journal of athletic training*. 2006;41(2):207.
25. Fitzpatrick AC, Naylor AS, Myler P, Robertson C. A three-year epidemiological prospective cohort study of rugby league match injuries from the European Super League. *J Sci Med Sport*. 2018;21(2):160-5.
26. Rubin HJ, Rubin IS. *Qualitative Interviewing: The Art of Hearing Data*. 3rd ed. Thousand Oakes: Sage Publications; 2012.
27. Smith B, Sparkes A. *Routledge Handbook of Qualitative Research in Sport and Exercise*. 1st ed: Routledge; 2016.
28. Patton M. Two Decades of Developments in Qualitative Inquiry. *Qualitative Social Work*. 2002;1(3):261-83.
29. Smith B, Caddick N. Qualitative methods in sport: a concise overview for guiding social scientific sport research. *Asia Pacific Journal of Sport and Social Science* 2012;1(1):60-73.
30. Miller P, Cronin C, Baker G. Nurture, nature and some very dubious social skills: an interpretative phenomenological analysis of talent identification practices in elite English youth soccer. *Qualitative Research in Sport, Exercise and Health*. 2015;7(5):642-62.
31. Christensen M. "An eye for talent": Talent identification and the "practical sense" of top-level soccer coaches. *Sociology of Sport Journal*. 2009;26(3):365-82.

32. Braun V, Clark V, Weate P. Using thematic analysis in sport and exercise research. In: Smith B, Sparkes AC, editors. Routledge handbook of qualitative research in sport and exercise: Routledge; 2016. p. 213-27.
33. Sparkes AC, Smith B. Qualitative research methods in sport, exercise and health: From process to product: Taylor Francis; 2013.
34. Sparkes AC, Smith B. Judging the quality of qualitative inquiry: Criteriology and relativism in action. *Psychology of Sport and Exercise*. 2009;10(5):491-7.
35. Burke S. How might we judge the quality of qualitative research in sport and exercise sciences? In: Smith B, Sparkes AC, editors. Routledge Handbook of Qualitative Research in Sport and Exercise: Routledge; 2016.
36. Smith B, McGannon KR. Developing rigor in qualitative research: Problems and opportunities within sport and exercise psychology. *International review of sport and exercise psychology*. 2017;11(1):101-21.
37. Tracy SJ. Qualitative quality: Eight “big-tent” criteria for excellent qualitative research. *Qualitative Inquiry*. 2010;16(10):837-51.
38. Morse J. Qualitative health research: Creating a new discipline. Walnut Creek, CA: Left Coast Press; 2012.
39. Brown R. Group processes: Dynamics within and between groups. 2nd ed. Oxford: Blackwells; 2000.
40. Kerr J. Whanau. Legacy. 1 ed. London: Constable; 2013.
41. Edmondson A. Psychological safety and learning behavior in work teams. *Administrative Science Quarterly*. 1999;44:350-83.
42. Roberto M. Lessons from Everest: The interaction of cognitive bias, psychological safety, and system complexity. *California Management Review*. 2002;45(1):136-58.
43. Edmondson A. Managing the Risk of Learning: Psychological Safety in Work Teams. In: West M, Tjosvold D, editors. *International Handbook of Organizational Teamwork and Cooperative Working*. London: John Wiley and Sons, Ltd; 2003.
44. O’Leary D. Team Psychological Safety: a significant factor in the development of interprofessional collaboration. *J Interprof Care*. 2016;30(1):29-34.
45. Kessel M, Kratzer J, Schultz C. Psychological Safety, Knowledge Sharing, and Creative Performance in Healthcare Teams. *Creativity and innovation management*. 2016;21(2):147-57.
46. Rathert C, Ishqaidif G, May D. Improving work environments in health care: test of a theoretical framework. *Health Care Manag Rev*. 2009;34(4):334-43.
47. Flessig A, Jenkins V, Catt S, Fallowfield L. Multidisciplinary teams in cancer care : are they effective in the UK? *Lancet Oncol*. 2006;7:935-43.
48. Powell TC. Total Quality Management as Competitive Advantage - a Review and Empirical-Study. *Strategic Management Journal*. 1995;16(1):15-37.

49. Reuveni Y, Vashdi DR. Innovation in multidisciplinary teams: The moderating role of transformational leadership in the relationship between professional heterogeneity and shared mental models. *Eur J Work Organ Psy.* 2015;24(5):678-92.
50. Axelsson SB, Axelsson R. From territoriality to altruism in interprofessional collaboration and leadership. *J Interprof Care.* 2009;23(4):320-30.
51. Ekstrand J, Lundqvist D, Lagerbäck L, Vouillamoz M, Papadimitiou N, Karlsson J. Is there a correlation between coaches' leadership styles and injuries in elite football teams? A study of 36 elite teams in 17 countries. *Br J Sports Med.* 2018;52(8):527-31.
52. Beck K, Beedle M, Van Bennekum A, Cockburn A, Cunningham W, Fowler M, et al. Manifesto for agile software development. 2001.
53. Ekstrand J, Lundqvist D, Davison M, D'Hooghe M, Pensgaard AM. Communication quality between the medical team and the head coach/manager is associated with injury burden and player availability in elite football clubs. *Br J Sports Med.* 2019;53(5):304-8.
54. Roncalgia I. A Practitioner's Perspective of Multidisciplinary Teams: Analysis of Potential Barriers and Key Factors for Success. *Psychological Thought.* 2016;9(1):15-22.
55. Fleissig A, Jenkins V, Catt S, Fallowfield L. Multidisciplinary teams in cancer care: are they effective in the UK? *The Lancet Oncology.* 2006;7(11):935-43.
56. Van der Vegt G, Bunderson JS. LEARNING AND PERFORMANCE IN MULTIDISCIPLINARY TEAMS: THE IMPORTANCE OF COLLECTIVE TEAM IDENTIFICATION. *Academy of Management Journal.* 2005;48(3).
57. Paletz SBF, Schunn CD. A social-cognitive framework of multidisciplinary team innovation. *Top Cogn Sci.* 2010;2(1):73-95.
58. Ke KM, Blazeby JM, Strong S, Carroll FE, Ness AR, Hollingworth W. Are multidisciplinary teams in secondary care cost-effective? A systematic review of the literature. *Cost Eff Resour Alloc.* 2013;11(1):7.
59. Pascale RT, Sternin J, Sternin M. The power of positive deviance : how unlikely innovators solve the world's toughest problems. Boston, Mass.: Harvard Business Press; 2010.
60. Drew MK, Raysmith BP, Charlton PC. Injuries impair the chance of successful performance by sportspeople: a systematic review. *Br J Sports Med.* 2017;51(16):1209-14.
61. Rongen F, McKenna J, Cobley S, Till K. Are youth sport talent identification and development systems necessary and healthy? *Sports Med Open.* 2018;4(1):18.