Institution: University of Chester		
Unit of Assessment: 24 Sport and Exercise Science, Leisure and Tourism		
Title of case study: Development and roll-out of a game-wide testing battery for rugby league players		
Period when the underpinning research was undertaken: 2015 – 2019		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	**Role(s) (e.g. job title):**	**Period(s) employed by submitting HEI:**
Craig Twist	Professor	2004 – ongoing
Jamie Highton	Associate Professor	2007 – ongoing
Samantha Moss	Senior Lecturer	2010 – ongoing
Period when the claimed impact occurred: 2016 – ongoing		
Is this case study continued from a case study submitted in 2014? N		

1. Summary of the impact (indicative maximum 100 words)

Research carried out by the University of Chester to assess the physical characteristics of rugby league players led to the first standardized physical testing battery for this group. This testing battery was adopted UK-wide by the Rugby Football League (RFL), engaging with 36 clubs that amassed to a total of 1236 players at non-professional (7 clubs; n = 124 players), women (2 clubs, n = 73 players), scholarship (U16s; n = 395 players), academy (U19s; n = 479) and senior (n = 165) standards. In developing the most comprehensive evaluation of physical characteristics for youth, academy and senior players in the UK, the main impact has been the standardization of monitoring procedures with comparative data between all UK clubs. The Rugby Football League, as key beneficiaries of this research, has been able to standardize between clubs and standards with procedures and a large database that enables between-club comparisons in player characteristics. Coaches have also benefitted with access to an evidence-based assessment protocol to appraise training and player development practices, both within and between playing groups. Finally, players have benefitted from the research with reliable and valid assessments of their physical qualities that have enabled better informed interventions to improve their training, performance and development.

2. Underpinning research (indicative maximum 500 words)

Before this research was adopted there was no consensus on the testing procedures for rugby league players in the UK, meaning that testing within and between clubs was different and often changed when coaching staff were replaced. These inconsistencies meant that clubs typically had limited or no longitudinal data on their players and were unable to make comparisons both within the club (i.e. between standards) and across other clubs. The RFL also had no overall view of the physical qualities of rugby league players in the UK, which impacted upon talent identification, player development and meeting the requirements of sports-related funding.

The research underpinning this impact-case study was conducted between 2015 and 2019 through a funded studentship supported by the RFL. The research team comprised three academic staff at the University of Chester (Professor Craig Twist [employed since 2004], Associate Professor Jamie Highton [employed since 2007] and Dr Samantha Moss [employed since 2010]), a funded PhD student (Nick Dobbin) and external advisors from the RFL (Jon Roberts, Richard Hunwicks). For the three-year period the project team also collaborated directly with coaching staff and players (n = 1236) from 36 clubs at both professional and amateur levels. The over-arching body of research includes a series of observational and experimental studies [1-5] in collaboration with the end-users that has contributed to developing, evaluating and rolling-out the Rugby League Athlete Profiling (RLAP) battery. This battery incorporated a series of tests to assess rugby league specific physical qualities, comprising 10 and 40 m sprint speed, countermovement jump, upper body medicine ball throw, slalom agility and a modified Yo-Yo intermittent recovery test. Some of these tests were already established while others were modified for the population and evaluated as part of the research (e.g. modified Yo-Yo intermittent

recovery test). Importantly, all data were collected by the research group, rather than by individual club staff, which strengthened the validity and utility of the data.

After an initial systematic review (unpublished PhD) and consultation with practitioners and athletes working in the game of rugby league, a suitable battery of tests was identified to assess the physical qualities of rugby league players. A series of studies [1-5] were then proposed to the governing body (RFL) that provided a comprehensive evaluation of the tests' reliability and validity before implementation across all standards of rugby league in the UK. Thereafter, the project adopted a longitudinal approach with multiple professional clubs to establish the contextual factors that influenced physical qualities of academy rugby league players across the playing year.

An initial project established the reliability of the RLAP [R1] using 50 professional players who performed the battery on three occasions. The study was also able to calculate for each test within the battery the required change (i.e. the performance improvement required was meaningful). This has been implemented within all clubs as an analytical goal that is enabling practitioners using the RLAP battery to confidently identify true changes in rugby league players' physical qualities due to training or detraining.

The initial review and consultation with practitioners highlighted the need for a rugby-specific intermittent test that incorporated the specific movement characteristics of rugby and was related to the physical and physiological demands of match play. Accordingly, a modified version of an intermittent running test (Yo-Yo intermittent running test), that had been used extensively in rugby league, was adapted to incorporate a key feature of the running demands associated with rugby league. Modification of the Yo-Yo test was supported with an experimental randomised crossover trail [R2] that confirmed the effects and validity of the alterations. The prone Yo-Yo IR1 was deemed to offer a more valid measure of rugby league-specific endurance and is now used to monitor rugby-specific running capacity in players within the UK.

Given that a key goal of the research was to offer a standardized battery of tests that would be used to offer game-wide evaluation of players at all standards, it was important that the battery possessed adequate discriminant validity between youth, academy and senior rugby league players. An observational study [R3] using 725 players from multiple professional clubs across the UK was conducted to determine that the RLAP battery could accurately distinguish between playing standards (i.e. youth, academy and senior levels). As well as establishing the RLAP's ability to discriminate between standards, the work also provided the most comprehensive data set on professional rugby league players that is now informing current and future athlete development practices at both national and club levels.

Final investigations of the project used a longitudinal approach with 197 players followed over two seasons to identify a number of contextual factors, such as season phase, league ranking, playing age and playing position, that influenced players' physical characteristics as monitored by the RLAP [R4]. The findings from this study highlighted how fundamental physical characteristics are impaired towards the end of the playing season, which posed implications for player performance and injury risk. This work then led to an intervention study [R5] to off-set these impairments using a rugby-specific high intensity, low volume training intervention. This study delivered a two-week 'micro-dosing' intervention with professional academy players that incorporated findings from earlier work [R2] and supports the inclusion of sport-specific actions to increase the systemic loads during intermittent running. The study demonstrated that this 'micro-dosing' approach to in-season conditioning improved key physical qualities of professional rugby players in only two weeks and was easily incorporated into training by coaches without compromising other training practices (e.g. technical or tactical training) or inducing additional fatigue to players.

3. References to the research (indicative maximum of six references)

[R1] Dobbin, N., Hunwicks, R., **Highton, J., & Twist, C**. (2017). A reliable testing battery for assessing physical qualities of elite academy rugby league players. Journal of Strength and Conditioning Research. 32, 3232-3238. doi: 10.1519/JSC.0000000000002280

[R2] Dobbin, N., **Moss, S., Highton, J., Twist, C.** (2018). An examination of a modified Yo-Yo test to measure intermittent running performance in rugby players. European Journal of Sport Sciences, 18, 1068-1076. doi: 10.1080/17461391.2018.1475509.

[R3] Dobbin, N., **Moss, S.L., Highton, J.,** & **Twist, C.** (2019). The discriminant validity of standardised testing battery and its ability to differentiate anthropometric and physical characteristics between youth, academy and senior professional rugby league players. International Journal of Sports Physiology and Performance, 14, 1110-1116. doi: 10.1123/ijspp.2018-0519.

[R4] Dobbin, N., **Moss, S.L., Highton, J.,** & **Twist, C**. (2019). Factors affecting the anthropometric and physical characteristics of elite academy rugby league players: a multi-club study. International Journal of Sports Physiology and Performance, 14, 958-965. doi: 10.1123/ijspp.2018-0631.

[R5] Dobbin, N., **Highton, J., Moss, S.L**., & **Twist, C**. (2019). The effects of in-season, low-volume sprint interval training with and without sport-specific actions on the physical characteristics of elite academy rugby league players. International Journal of Sports Physiology and Performance, 15, 705-713. doi: 10.1123/ijspp.2019-0165.

4. Details of the impact (indicative maximum 750 words)

The beneficiaries of this applied research have been the RFL, the management and coaching staff of UK rugby league clubs and the players who these coaches support at youth, academy and senior standards. The research has provided the first standardized physical testing battery and comprehensive data set for rugby league players in the UK. Before this research, there had been no consensus on the most appropriate tests to use for rugby league players, with all clubs employing a testing battery determined by their own coaching staff or no testing battery at all. The implementation of a practical, valid and reliable testing battery has offered consistency and therefore made a meaningful impact on the monitoring practices of UK professional rugby league clubs. This has enabled coaches and practitioners to have confidence in the utility of the data and enabled game-wide comparisons of individual player's data with those of others in the UK.

The Rugby Football League

The research has had impact for the governing body by providing an evidence base to standardize game-wide monitoring procedures. As part of club accreditation, the RFL have now mandated all academy and women's teams to use the RLAP battery as a component of the athlete support monitoring process, with all data fed centrally to the governing body to inform a player database. This is being used to inform player development initiatives and track career trajectories of players. The continued application of the RLAP battery by the sport's national governing body (RFL) is therefore serving a number of important functions nationally.

"The physical testing battery, which was co-developed between the University of Chester and the Rugby Football League, has been used across all men's and women's Super League clubs and Academies. The University of Chester validated the testing battery, which is used to profile players for international selection, and also track the longitudinal development. The testing battery is used across performance, player welfare and injury prevention initiatives, therefore fundamental to a number of RFL projects" (Head of Performance, The Rugby Football League, [S1])

"The Rugby League Athletic Profile (RLAP) has provided the sport with a specific battery of physical tests for developing and elite athletes. This battery has been regarded as an 'industry standard' and allowed individual athletes and their Clubs a diagnostic tool in order to be able to change training and coaching practices to meet the individual needs of players to drive improvement." (Chief On-field Officer, Rugby Football League, [S1])

"The Rugby League Athlete Profile Project (RLAP) was the driving force behind this comprehensive assessment of Senior, Junior and Women's physical characteristics. A project with the value and impact of this has not been seen in the professional game before. The work led by

Nick Dobbin did and continues to assist with the physical preparation of athletes at all levels of the game." (Former Head of Performance, The Rugby Football League, [S2])

The Clubs

The impact from the research is manifest in coaches across the standards (scholarship, academy, women and seniors) at all 12 Super League clubs having access to the data to make direct comparisons of the physical qualities between players. Those coaches selecting representative players or players who are targeted from outside the professional system, who might otherwise have been overlooked (i.e. amateur and school standard players), are also benchmarked against the standards provided by our research. The RLAP battery has also been implemented within amateur rugby environments to identify talent and offer those players who are unlikely to have access to the professional environment. Use of the RLAP battery as part of the player support processes are confirmed by those working across the clubs in the UK.

"The project was essential in establishing the baselines and measurement of progress physically of the players in our system. Without it we had no other way of being able to ascertain the impact of the training interventions. Key to this data was the consistency of obtaining the data. This was done exceptionally to ensure robust and accurate findings to underpin the work done on the England RL Talent Pathway." (National Player Development Manager, Rugby Football League, [S1]).

Based on our work, the RLAP battery is implemented by clubs at key phases of the season in an efficient manner to provide insight into a player's training status or, more importantly, the development of a player over time. The RLAP battery, measurement properties, and normative data are not only supporting player identification and development but also the interpretation of longitudinal changes in players' physical characteristics that evaluate the effectiveness of club training programmes. The data from our research is also supporting the generation of a game-wide data platform, developed by the RFL and researchers at Leeds Beckett University. This is a meaningful resource that has enabled clubs to manage and better support their players using a centralised system.

"The RLAP testing has had a significant impact on the way that we use testing and the subsequent data. Prior to this we had very little context to the data apart from how our players compared within our environment, something that we did not find overly beneficial as more often than not it was information we already knew. However, being able to compare players to the national averages and z-scores from their own age group as well as those of more senior age groups (England Knights and Elite) has allowed us to add more value to the results, recognising those who stand out when compared to the wider group of players nationally. We have also then used this data to produce a scoring range and grading system for our players - which has allowed us to further individualise and challenge players to continue progressing." (Head of Youth Development, Newcastle Thunder RLFC, [S3])

"The RLAP was a massive help. It gave us an idea of how our players were performing from a physical standpoint at vital times in the season. The results were with me within 24 hours of testing and were easy to interpret for both myself and our head coach/head of youth. The results were used in our monthly player reviews, from which players were able to set targets for areas for development. Allowing me to compare results to 1st team Super League and academy internationals helped inform me of any areas our team/certain players may be falling behind in, which could then inform future training programmes for the players." (Head of Academy Strength and Conditioning, Warrington Wolves RLFC, [S4] [S7]).

"The RLAP testing done by … the team allowed us to build a picture of what a youth rugby league player looks like at each stage of their development. Due to the length of the study, it allowed us to build a large data base over a number of years which then meant we could gauge what a successful future player would look like at each stage. This data helped us to have a more informed opinion when making recruitment and retainment decisions on players." (Strength and Conditioning coach, Wigan Warriors RLFC, [S5]).

A key observation from the research was the reduced physical performance in the late season which had the potential to affect players' performance or injury risk. Our findings on the short-term adaptations to high intensity exercise performed in season were therefore important in informing practitioners regarding how to adopt appropriate training strategies that, as a consequence of our research findings, are more confidently incorporated at key phases of the year. For example, "We were also able introduce in season micro-dosing approaches [small intensified conditioning blocks] with our players that were based on the work we had conducted with Nick Dobbin – a former PhD student at the University of Chester. Despite the radical changes in training and playing schedule due to the Covid-19 pandemic, it is something we have continued to employ this year. As a performance team we are therefore able to see the positive impact these [research findings] have had on both player and team performance as well as preparedness for match play." (Head of Strength and Conditioning, St Helens RFC, [S6]).

"The RLAP testing was of great importance to us to help guide our physical preparation of academy players. The testing gave us information that allowed us to adjust training and our focus of adaptation accordingly." (Coach, Huddersfield Giants RLFC, [S8]).

Players

A total of 1236 players were initially tested using the battery, which now continues with the use of the RLAP game-wide to support those players currently in the system. The impact on players was the provision of higher quality information on their longitudinal training adaptation that ensured any subsequent training prescription was appropriate to maintain performance and reduce injury risk. A rapid and functional feedback mechanism ensured players received feedback within 24 h of testing four times per season, and in academy players the centralisation of data to the RFL ensured long-term monitoring of players. Furthermore, better understanding of seasonal variations, that had previously been unknown in rugby league players, and the subsequent development of suitable training approaches impacted upon players' performance capability. Players acknowledged the usefulness of the RLAP as part of their development.

"[the testing battery] … really informs our training and motivates me to be better. It gives the coaches numbers that he can talk to me about my fitness and where I can improve. Being able to compare myself to other players in the country in my position is also really useful." Academy player, Warrington Wolves RLFC, [S4]).

5. Sources to corroborate the impact (indicative maximum of 10 references)

[S1] Rugby Football League
[S2] Catalan Dragons
[S3] Newcastle Thunder RLFC
[S4] Warrington Wolves RLFC
[S5] Wigan Warriors RLFC
[S6] St Helens RFC
[S7] Widnes Vikings RLFC
[S8] Huddersfield Giants