

Institution: University of Chester
Unit of Assessment: 24 Sport and Exercise Sciences, Leisure and Tourism
1. Unit context and structure, research and impact strategy

Background

The submission for this unit of assessment (UoA) is based on the Department of Sport and Exercise Sciences' progressive research profile in areas aligned to physical education (PE), sociology of sport and, in the last 15 years, applied sport science. A clear strategy outlined in REF2014, combined with collaborative efforts throughout the current REF period has resulted in the Unit retaining many of the staff (77%) submitted to REF2014 (note retirement of leading figures in Roberts et al.) and maintained research activities that reaffirm its **vitality and sustainability**.

In meeting the institution's REF Strategy for 2014-2021, the Unit has sought to cultivate knowledge that has contributed to research and scholarly activity that has enriched those in society and working in sport and exercise communities. As proposed in our REF2014 submission, the Unit has used the last six years to successfully develop its group of early career researchers who, along with more senior academics, have established a purposeful and progressive research contribution to applied practice, sports policy and PE. This was important given the rapid growth in the Unit's research activity between 2008 and 2014 and the proportion of early career researchers in our last submission (5 out of 13 in REF2014).

Research Groups

The last assessment period has seen staff collaborate on research more widely, with 33% of total outputs generated from external collaboration. The remaining 41% and 26% of outputs have emanated from PGR student supervision and colleagues' individual work, respectively. Collectively these developments confirm the over-arching strategic goal of our 2014 submission in terms of developing a self-sustaining research culture that underpins the research groups.

Against that backdrop, and alongside key changes elsewhere across the HE sector, the period towards REF2021 has seen a consolidation of the Unit's two established research groups: **Applied Sports Sciences** and **Sociology of PE and Sport**. Taken together, these have enabled further development of the key areas of physical sciences (comprising physiology, biomechanics, psychology and performance analysis) and social sciences (comprising sociology and PE). The two research groups are representative of staff interests and practitioner expertise, and continue to inform the strong postgraduate programmes in Sport Sciences and Sociology of Sport housed within the Unit.

Consistent with the institution's research strategy, the type of research conducted has direct transfer to the teaching activities of all staff and ensures students are exposed to contemporary, research-informed content at both undergraduate and postgraduate levels. The research from both groups has continued to employ theoretically- and practically-informed, empirical and applied research illustrated by a breadth of intellectual and methodological approaches. At the same time, the groups have sought to adopt more extensive methodologies, including the use of inter-disciplinary approaches, in order to offer more robust and comprehensive answers to key applied questions.

Applied Sports Sciences

This Group has adopted a mixture of laboratory- and field-based approaches, including:

- innovative methods applying advanced measurement techniques (e.g. muscle biopsies) to understand team sports in the field (e.g. [doi: 10.1016/j.jsams.2016.03.008](https://doi.org/10.1016/j.jsams.2016.03.008))
- engaged with new problems to understand novel methodological techniques for measuring human performance (e.g. [doi: 10.1123/ijssp.2016-0069](https://doi.org/10.1123/ijssp.2016-0069))
- employed real world studies with large sample sizes (e.g. [doi/full/10.1080/17461391.2018.1552722](https://doi.org/10.1080/17461391.2018.1552722))

- sophisticated analyses to explore complex interactions between measures of human performance (e.g. doi.org/10.1123/ijspp.2018-0631).

The Sociology of PE and Sport

This Group has utilised a range of theoretical perspectives, including:

- figurational sociology (e.g. doi.org/10.1123/ssj.2017-0002)
- Foucault (e.g. doi.org/10.1080/13573322.2015.1114917)
- grounded theory (e.g. doi.org/10.1080/13573322.2019.1634043)
- methodologically, it has employed
 - conventional interview (individual and group; e.g. doi.org/10.1080/13573322.2019.1634043; doi.org/10.1080/2159676X.2017.1323778)
 - questionnaire (e.g. doi.org/10.1080/03004279.2016.1155072)
 - observation (e.g. doi.org/10.1080/13573322.2012.761965)
 - documentary analysis (e.g. doi.org/10.1016/j.tranpol.2018.09.012)
 - novel methods such narrative reviews (e.g. [doi:10.1016/j.tranpol.2018.09.012](https://doi.org/10.1016/j.tranpol.2018.09.012)).

The continued engagement and close collaboration of both groups with those in sport, exercise and teaching environments has ensured practitioner-driven questions remain at the heart of the Unit's research objectives. For example, funded (Rugby Football League) work by **Twist**, **Highton** and **Moss** has developed a UK-wide monitoring battery in professional rugby league. Similarly, **Twist** and **Green's** collaborative report funded by British Athletics produced an interdisciplinary appraisal of talent development literature that has informed the structuring of youth talent structures across the Home Nations' governing bodies. **Moss's** work with Arsenal Women and Gatorade has provided interventions to female athlete health. The work of **Bloyce** and **Pritchard** has also been used to inform the work of the Chief Medical Officer working with professional golf.

Staff Development

Given the relatively high proportion of early-career researchers in the Unit's 2014 submission, the subsequent seven-year period leading to the 2021 submission has enabled the nurturing of this talent towards fully-fledged, independent researchers while, at the same time, progressing the research activities of senior academic staff. This is consistent with the institution's strategy of peer mentoring, which has given established staff the opportunity to develop their own skills whilst supporting younger, less experienced colleagues. The Applied Sports Sciences Research group was formed based on the engagement of colleagues with professional and elite sports organizations and the movement of many students from our undergraduate and postgraduate programmes into these environments, thus facilitating the delivery of applied research in supporting and informing elite sporting practice. Similarly, the Sociology of PE and Sport group have sought to enhance junior colleagues' involvement in research via, among other things, peer-reviewed articles (e.g. Wheeler & Green, 2019; Fry & Bloyce, 2017).

Those who in 2014 were early career researchers now have a significant responsibility for research (e.g. **Highton**, **McEvilly**, **McWhannell**, **Moss**, **Thomson**) and, under the guidance of senior academic staff (**Bloyce**, **Green**, **Lamb**, **Twist**), have engaged with and contributed positively to the supervisory process. This emphasizes not only our commitment to doctoral training of students, but also the training and support of staff to supervise and provide successful postgraduate training. Those previously identified as early career staff have also gained promotion during the seven-year period to Associate Professor (**Highton**) and Senior Lecturer (**McEvilly**, **Moss**, **Thomson**), reinforcing the unit's focus on staff development. Since REF 2014, there have also been promotions of senior academic staff to Professorial status (**Lamb**, **Twist** and **Worsfold**) and Associate Professor (**Bloyce**).

Embedding Research in Education

Research activities have also continued to provide a key basis for undergraduate and postgraduate teaching within the Unit (Figure 1). Indeed, the symbiosis of research and teaching has ensured that students experience contemporary and comprehensive learning opportunities that have enabled them to engage with a range of research and applied activities to develop fundamental and

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employment-related skills. For example, the research of the Applied Sport Sciences group has informed the curricula of the highly successful MSc Sport Sciences programme and enabled students to engage with applied research projects with high performance sporting organisations. Similarly, the work of the Sociology of PE and Sport group directly informs the learning and development of those students on the BSc Physical Education and MSc Sociology of Sport and Exercise. Collectively, the research informed teaching approach ensures currency of the degree programmes and that Sport and Exercise students from the University of Chester are well prepared to become good, critical and independent thinking citizens.

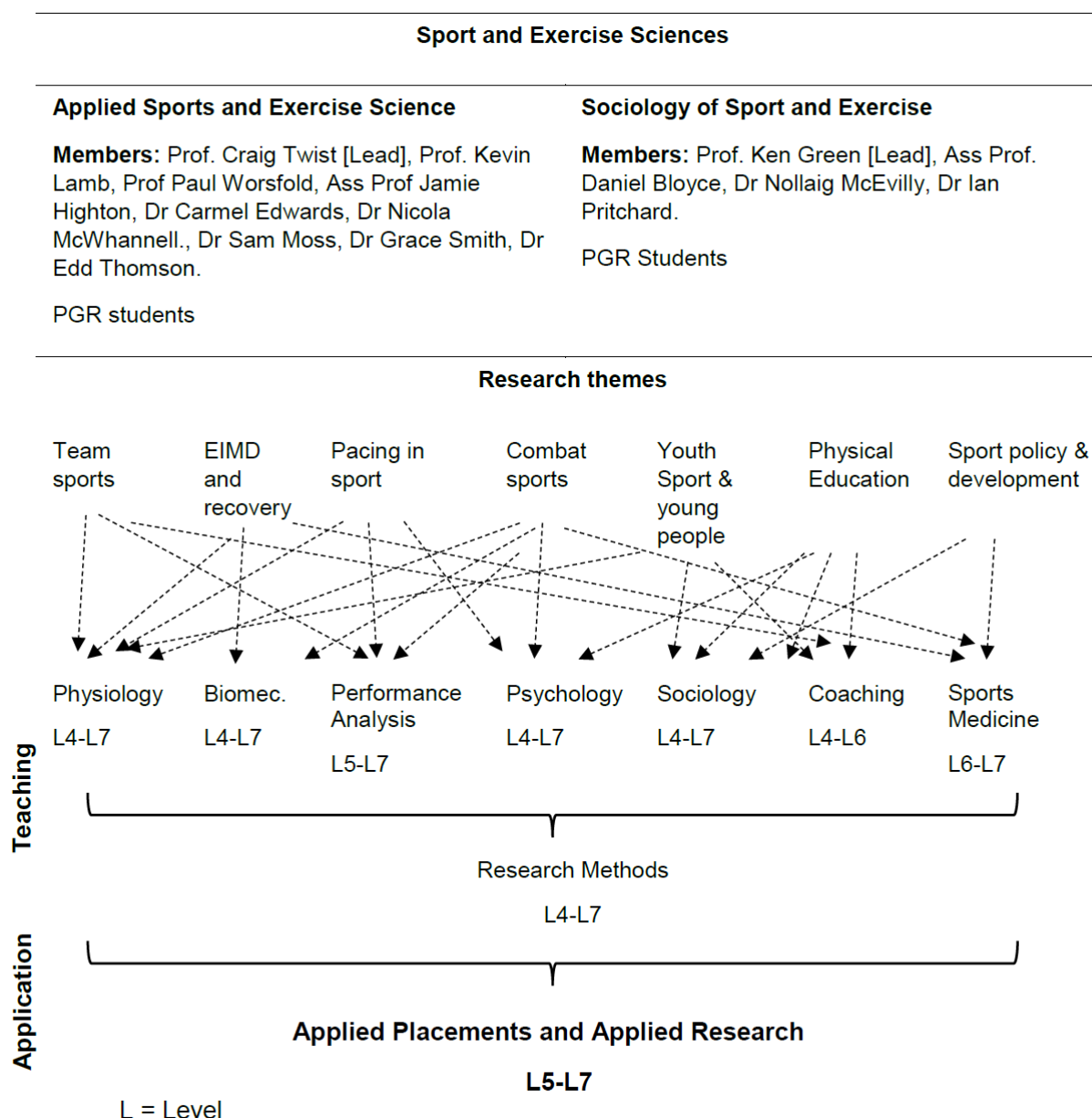


Figure 1. Embedding Research in Education: Sport and Exercise Sciences research groups, research themes and contributions to undergraduate and postgraduate teaching.

Strategic Aims (beyond REF2014)

Strategic objectives of the REF2014 submission were identified for both research groups.

For the Applied Sport Sciences, the main objectives were to:

- Extend the group's work in rugby with a particular focus on player health.
- Introduce a focus on psychology.
- Develop applied work into other sports (especially martial arts).

Complimenting this, the Sociology of PE and Sport group aspired to:

- i. Extend its research interests in children and young people's engagement with PE and sport.
- ii. Examine new and complex problems in the form of comparative studies of parental cultivation of youngsters' sporting capital, youths' leisure and sporting lifestyles, and school PE in England and Norway.

For both groups there was also an objective to develop and strengthen collaborations with overseas groups, and the narrative below demonstrates where the Unit has delivered against these targets:

Rugby Research

A deeper understanding of the applied implications of our rugby research emerged in the doctoral studies of **Finnigan**, **Norris**, **Mullen** and **Dobbin**, all of whom completed within the 2014-2021 assessment period. These projects were externally funded (**Finnigan** (nee **Cahill**, Rugby Football Union; **Dobbin**, Rugby Football League) or supported by QR funding (**Norris** and **Mullen**) and involved close collaboration with the end users to produce research that impacted practice within the sport; e.g., Finnigan's (RFU) and Dobbin's (RFL) work on player monitoring with all professional teams in England has produced several peer-reviewed papers

(e.g. <https://doi.org/10.1080/02640414.2012.727456>; <https://doi.org/10.1123/ijssp.2018-0631>; <https://doi.org/10.1123/ijssp.2016-0603>).

This work has also been extended to applied research with England Touch rugby led by **Highton** and **Twist** and through the PhD of **Cropper** – seeking to understand the performance, health and injury risk of elite and recreational male and female Touch players. In collaboration with colleagues at Manchester Metropolitan and Bath Universities, this work has produced the first detailed appraisals of the competition demands (<https://doi.org/10.1123/ijssp.2019-0594>) and incidence, severity and nature of injuries sustained during tournament play that has been used to support the development of an evidence-based training and injury prevention programme (<https://doi.org/10.3390/sports7030071>). Funding from the Rugby Football League also enabled two sponsored MRes projects (supervised by **Bloyce** and **Twist**) that adopted an inter-disciplinary approach to examine the health benefits of Touch rugby (<https://doi.org/10.1007/s11332-020-00636-4>).

Applied Sport Sciences Research

The research interests of early career staff have been supported to yield additional impact-related work in new areas germane to the Applied Sports Sciences group. For example, the work of **Thomson** produced several publications from his PhD (supervised by **Lamb**) that have contributed to applied collaborations with colleagues at British Boxing and the English Institute of Sport (e.g. [doi:10.1519/JSC.0000000000001749](https://doi.org/10.1519/JSC.0000000000001749); <https://doi.org/10.1080/24748668.2016.11868881>). This work has subsequently led to the PhD of Stanley (supervised by **Thomson**, **Lamb** and **Smith**) that used a multidisciplinary approach to evaluate the determinants of maximal punching and intervene in the training practices of male boxers (<https://doi.org/10.1080/24748668.2018.1525651>). Similarly, recent work led by **Moss** in collaboration with colleagues at the Gatorade Sport Science Institute, Arsenal Women and Manchester City Women football clubs has generated novel and practically meaningful work on the energy availability and injury risk factors in professional female soccer players (<https://doi.org/10.1080/17461391.2020.1788647>).

Psychology of Athlete Performance and Health Research

The work of the Applied Sport Sciences group has been extended with the introduction of research aimed at understanding the psychological dimensions of performance and athlete health. The PhD of **Mullen** (supervised by **Highton** and **Twist**) adopted a novel approach to examining the cognitive and perceptual contributions to training and competition load in elite and sub-elite team sports. This work also compliments the novel psycho-physiological work of **Highton** into pacing in team sports (in collaboration with former PhD student Waldron; [doi:10.1007/s40279-014-0230-6](https://doi.org/10.1007/s40279-014-0230-6)), and mass participation endurance events (with **Moss** and colleagues at Inland University, Norway; <https://doi.org/10.1080/17461391.2018.1552722>). **Moss** has studied the psychological Implications of weight management practices in female athletes (<https://doi.org/10.1123/ijsnem.2019-0037>) and the

role of music on exercise performance (<https://doi.org/10.1016/j.psychsport.2018.05.002>). The ongoing PhD of Pentith (supervised by **Edwards, Moss** and **Lamb**) is exploring the coping mechanisms used by young Irish dancers who have experienced pain and injury.

International Reach of Research

Overseas collaboration since 2015 has been met through work between the Unit (namely, **Moss, Highton** and **Green**) and colleagues at the Inland Norway University of Applied Sciences, Norway. This work, targeting both public health and applied sports performance objectives, secured funding of £60,000 from the Regional Research Council of Norway (Regional Research Fund grant number 271014) to examine the Birken mass-participation event. The project has begun to establish the major factors affecting participation in the event, including environmental, psychological and sociological factors, attempting to develop strategies to increase participation for all. Furthermore, increased knowledge of the demands placed on participants of the Birken races has provided evidence-based information to inform appropriate advice and recommendations for participants. The collaboration has produced two peer-reviewed outputs ([doi:10.1080/17461391.2018.1552722](https://doi.org/10.1080/17461391.2018.1552722); [doi:10.3389/fpsyg.2019.02548](https://doi.org/10.3389/fpsyg.2019.02548)), a video abstract promoted by a respected journal, three presentations at an international conference (European Congress of Sport Science), a magazine article for Birken participants and a press release. The funding has also supported two post-graduate students (one from each institution) as research assistants, and one MRes student. **Green's** collaboration with Norwegian colleagues has resulted in a number of articles on PE, sport, mental health, parental cultivation of children's sporting capital and habits (e.g. doi.org/10.1080/13573322.2017.1401991; doi.org/10.1080/13573322.2019.1634043; doi.org/10.1177/1356336X19862303) as well as an edited collection on Sport in Scandinavia and the Nordic Countries (Green, Sigurjonsson & Skille).

Strategic Aims (beyond REF2021)

The Unit has identified five Strategic Aims to provide the focus for its research activities in the 2021–2028 period. These are:

- i. Continue to develop novel and rigorous sports-related research of international significance within the two broad areas of Applied Sports Sciences and Sociology of Sport and PE.
- ii. Strengthen further the teaching-led research within the Unit that enables staff and students to engage with pertinent research activities and develop the necessary skills and qualities to be confident, independent thinking world citizens.
- iii. Develop more the use of inter- and multi-disciplinary research approaches, both within and beyond the Unit, to deliver higher quality research and teaching that is applied and has potential to impact industry, the public sector and the wider economy.
- iv. Increase competitive grant capture and seek to further develop UK and international projects.
- v. Exploit opportunities to facilitate high quality research, teaching and staff development by forging purposeful and coherent working relationships with the institution's new Medical School.

The ambition of the Unit's research groups is to increase the volume of novel and rigorous applied research that has international reach and, where appropriate, adopts multiple disciplinary (i.e. inter- and multidisciplinary) approaches to answer complex problems. These will also align with the University's core themes, focusing on education and communication, impact and engagement with users. Given the centrality of research-informed teaching for more than 15 years, the Unit is also well placed beyond 2021 to meet the institution's vision of teaching-led research. With research already embedded strongly within the undergraduate and taught postgraduate curricula, we see this as an opportunity to further strengthen our approach and ensure research plays a key role in developing the 'Citizen Student'.

Building upon the new multidisciplinary research approaches within the Unit and existing engagement with industry, research interests and engagement will be harnessed to ensure a rich and meaningful learning environment for students. For example, the development of new programmes, such as the BSc in Applied Sport Performance, and the renewal of existing modules at undergraduate and postgraduate level will use the research experience of staff to engage students with applied research activities that develop important research knowledge and skills. These will

enable staff and students to partner with industry and address contemporary and real-world research questions that has potential to impact the behaviours and policies of the end user.

In **Applied Sport Sciences**, the group will:

- i. Examine further the training practices and adaptive responses in elite team sport athletes, martial arts and endurance exercise (i.e. cycling).
- ii. Build on existing developments and appetite of colleagues for multi-disciplinary research to strengthen future research activity, combining physical and social sciences.
- iii. Develop studies into under-researched groups that have direct impact on the end-user.
- iv. Progress opportunities for research collaboration within the institution, notably with the newly establish Medical School.

Examples to support the above include: extending the approaches adopted by the PhD studies of **Mullen** (supervised by **Highton** and **Twist**) to examine further the training practices and adaptive responses in elite team sport athletes. This is underway with the work of **Fairbank** (funded studentship by St Helens RFC), which has involved the first comprehensive descriptive studies examining the training loads and periodisation structures used in elite rugby league. Similarly, the PhD of **Shergill** (sponsored by Aston Villa FC) has provided the first detailed assessment of match running using global positioning system tracking and the study of data quality. The intention is to extend the work of **Fairbank** and **Shergill** using more experimental approaches that explore more fully the multi-faceted adaptive responses (i.e. physiological, cognitive and skill) to different game-based training and monitoring approaches. The group will also develop the work of **Thomson** and **Stanley** – exploring the analysis, preparation and performance during boxing training and competition – to study martial arts. The ongoing work of **Chorley** (supervised by **Lamb**) will also seek to develop novel aspects of applying the critical power concept to advise cycling training prescription. Multi-disciplinary research will emerge via the cross-discipline approaches within the physical sciences from the PhD work of **Oxendale** (supervised by **Smith**, **Highton** and **Twist**), combining physiology and biomechanics, to provide a deeper understanding of the biomechanical and physiological loading associated with multidirectional activity and the implications for injury risk. Such work will marry neatly with the ongoing empirical research in injury epidemiology in Touch rugby by **Cropper** (supervised by **Twist**), the studies of **Pentith** (supervised by **Edwards**, **Moss** and **Lamb**) in Irish dancing and the recently funded project from Gatorade and Manchester City Women in the PhD of **Anderson** (supervised by **Moss**) examining the role of menstrual cycle and nutrition on female athlete health and performance. The multi-disciplinary approaches in the ongoing PhD of **Mulvenna** (supervised by **Thomson**, **Bloyce** and **Twist**) have also made way for preliminary work from **Bloyce** and **Twist** to examine knowledge transfer and use of sport science by coaches in high performance sports, such as cycling, gymnastics, and athletics. This cross-discipline collaboration will complement the established research interests of the Applied Sport Sciences group in athlete monitoring to converge ideas and offer impactful outcomes to develop appropriate coach, athlete and scientist education.

In **Sociology of PE and Sport**, the group will explore:

- i. The experiences of pre-school and early years children in PE, including transitions from primary to secondary PE.
- ii. The lessons to be learned from sports participation patterns and trends in the Nordic countries.
- iii. The relationship between PE, sport and mental health.
- iv. The mechanisms by which parents and friends influence children's early socialization into sport.
- v. The outsourcing of school PE to external providers.
- vi. The presentation of the body in social media.
- vii. The impact of money and relationships among professional sportspeople.
- viii. Active travel and health policies.
- ix. The impact of organizational change within national governing bodies of sport.

For example, the current studies of **Foulkes** and **Lal** (supervised by **Green**) will contribute further research to the role of physical education in primary schools and the issues in primary to secondary

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transition. **Reid's** doctoral work (supervised by **Green**) will offer a sociological study on the lifestyles of elite youth athletes. **McEvilly** is already engaged with collaborative research examining the outsourcing of physical education to external providers, as well as work on preschool children's, parents' and practitioners' engagement with discourses related to health, bodies and physical activity, through the PhD studies of **Healy**. The PhD of **Hook** (supervised by **McEvilly** and **Pritchard**) also seeks to adopt a sociological approach to better understand the presentation of the body on social media, with a particular focus on a Foucauldian reading of self, surveillance and space. Finally, **Bloyce**, working in collaboration with current (**White** and **Thompson**) and past PhD students (**Fry** and **Law**), will continue on a range of work exploring the working lives of professional sports people, and the impact this has on well-being, examining the workplace of professional sport, organisational change in national governing bodies, and the impact of active travel policies on health promotion. Finally, the work of **Green**, **McEvilly**, **Bloyce** and **Pritchard**, will explore, among other things, national and international participation in health-related physical activity and sport, both in schools and beyond.

Aligning to the Institutional Strategy

The impact of the Unit's continuing research activities will be targeted towards key wider sport and exercise agendas and coherence with institutional research themes. Moreover, research collaboration with the institution's Medical School will use multi- and inter-disciplinary approaches to complement clinical issues relating to health, wellbeing and physical activity that will naturally dovetail with the institution's mission and core research themes; notably Health and Wellbeing, Culture and Society, and Regional Economy. We anticipate that our long-running research in applied sport will continue to impact on the practices of those coaches working in rugby league, football and a range of Olympic sports via the English Institute of Sport. New endeavours will extend the ongoing work of **Bloyce** and **Twist** using modified rugby to improve health (e.g. doi.org/10.1007/s11332-020-00636-4), as we seek to use such initiatives that impact key targets of *health* and *wellbeing* by engaging a range of local socioeconomic groups within the local communities of Chester and Warrington. The existing work of **Bloyce**, **Highton**, **McWhannell** and **Twist** will explore how research with elite team sports can be used to improve health, wellbeing and physical activity of less active adults and children. Similarly, building on the success of the recently established Sports Medicine taught postgraduate programme and the work of **Thomson**, developing integrated approaches to understand health and wellbeing of combat sports will continue in collaboration with colleague at the English Institute of Sport. We anticipate that further impact to the *regional economy* is also a likely outcome.

Using the research of **Green**, **Highton**, **McEvilly**, **McWhannell**, **Moss**, **Twist**, **Thomson**, and **Worsfold** we will also target *education* and *dissemination* of research outcomes in two distinct ways:

- i. to inform existing and develop new undergraduate and postgraduate curricula;
- ii. develop new, degree-level short course material targeted as those individuals seeking ongoing professional development.

In particular, we aim to extend some of the work that has already been initiated with the likes of British Cycling, Rugby League, British Boxing and women's football. In addition, the newly developed 'Teach Meet' that engages local teachers from the North West with applied research will be developed and informed by the work of those within the research groups. Our particular target groups will be coaches, practitioners, medics and teachers, with impact considered as changes in practice and behaviour of the end users of the research and how it influences those people that they work with. Again, such initiatives are likely to make an impact *culturally* and *socially* and towards the *regional economy*.

2. People

Staffing Strategy

Staffing has remained stable over the REF period 2014-2021, with 77% of staff submitted in 2014 submitted again in 2021. Those staff that are not included have either moved to new posts or retired. The only addition to the staffing base is that of **Moss** whose appointment in 2014 was consistent

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with the strategy to promote strong postgraduate students from within (e.g. **Highton, Thomson**), who are aligned with the Unit's research strategy and possess potential to enhance further the work of one or both of the research groups. The stability in staff over the last two assessment cycles is testament to the effectiveness of the Unit's recruitment strategy that ensures a sustainable research environment. This also serves to inspire and encourage younger researchers, both at taught and research degree level, and enable them to engage within a vibrant and supportive research culture.

Early Career Researchers (ECRs)

In our 2014 submission we made clear that new ECRs would be strongly encouraged to become members of supervisory teams and, where feasible, co-supervisors for PhD students. The success of those colleagues that were considered ECRs in 2014 is defined clearly by their contributions to outputs, PhD supervision, completions and external roles in the assessment period up to 2021 and indicate the Unit's commitment to support early career researchers at the beginning of the academic careers.

This group of individuals have progressed to posts with significant responsibility for research (**Highton, Moss, Smith, McWhannell, McEvilly, Thomson**) and has collectively contributed approximately 50 lead and co-authored outputs, six co-supervised completions and eight PhD examinations since 2014. They have been supported by senior academic staff, who have acted as mentors to develop and implement a successful and individualised research strategy, working in accordance with the Research Development Concordat. In addition, *Annual Professional Development Reviews* are used by the Head of Department (HoD) to focus on the needs of all research-active staff as well as research outcomes and planning.

Under the guidance of the Research Development Officer (RDO), senior researchers provide support to enable less experienced colleagues to meet their research and development needs. This takes the form of identifying areas of individual specialism that might contribute to larger projects and input as co-supervisors, support to pilot research ideas using undergraduate and taught postgraduate student projects, use of small internal funds to pump-prime research projects, support for identifying income generation streams and invitation to act as Internal Examiners. Examples of this include contribution of statistical expertise to the PhD of Dobbin (**Highton**) and methods expertise (**Smith**) to the PhD of **Oxendale**, targeted supervision of student projects that has resulted in peer-reviewed outputs (**Edwards, McWhannell**), support for funding bid writing to secure internal funds for PhD studentship (**Moss**), and appointments as Internal Examiner to PhDs (**Edwards, McEvilly, McWhannell, Thomson**).

All staff, regardless of career stage, are encouraged to comply with institutional research quality and standards regulations by completing appropriate supervisor development at least every three years. These include completion of institutional online training resources, e.g. Core Training for PGR Supervisor workshops, PGR Interview Training, Internal Examiner and Independent Chair workshops, participation and contribution to relevant internal and external conferences/workshops.

Staff Development

In terms of staff development, ~£5k per annum of the Unit's QR funds and a central Faculty Research Support Fund are available to support individual researchers and their PhD students to attend conferences. In the research period to 2021 all research staff have attended at least one international conference per year (e.g. ECSS, BASES). Research-active staff can apply for research sabbaticals for periods of empirical research and/or writing-up. Staff are also encouraged to make use of the suite of development activities provided centrally by the university, such as workshops on mentoring, good supervision, examining, workload management, and grant capture. These are available through the Research and Knowledge Transfer Office and communicated via the Unit's RDO.

Staff are afforded time to stimulate and facilitate exchanges between the Unit and industry. This serves to generate research funding, develop strong collaborative research links that produces impactful research, informs teaching and offers staff and students valuable insights into industry that shapes future research and offers professional development opportunities. Examples include the secondment of **Worsfold** to the English Institute of Sport; **Twist's** work with St Helens RFC and

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British Cycling; **Moss** with the Gatorade Sport Science Institute. These opportunities are discussed in accordance with the HoD as part of Annual *Professional Development Reviews* and incorporated within each individual's work load allocation.

Managing Workload

Staff workloads are managed by the HoD in conjunction with the Deputy HoD and the RDO. The teaching loads of research-active staff are typical of teaching-facing institutions, such as Chester, so are much higher than those at more research-focused institutions. This notwithstanding, the value placed by the Unit and Institution on research-informed teaching and the importance of research in maintaining a current and engaging curriculum at all levels is reflected in the commitment of staff to balance all components of their overall workloads. To this end, staff are allocated the statutory hours as permitted by the institutional workload allocation, but are also supported during periods where teaching commitments are reduced. In this way they are able to identify periods of time where they focus on research activity. The Unit has also successfully used both QR and external monies to fund the appointment of four short-term research assistants over the assessment period that have been able to support staff in research activity. For example, **Twist** and **Highton** were allocated funds to appoint two graduate research assistants for a six-week period to conduct data collection on an applied study that answered questions posed by practitioners on warm-up duration and rugby performance. This work (<https://doi.org/10.1080/24733938.2020.1819558>) provided information that impacted on the training practices in rugby league and has been circulated widely on social media, across a range of team sports.

Equality and Diversity

The Unit, guided by the Equality and Diversity officer (**Moss**), works to provide a research environment that enables all staff to fulfil their potential, promoting equality regardless of race and gender. The Unit gender balance is 1:0.9 in favour of males, with positions of responsibility distributed evenly between sexes (1:1). In addition, those staff returning from periods of leave, due to parenting leave, ill-health or caring responsibilities, have been supported via meetings with the HoD and RDO to facilitate appropriate workload management and support for their research needs. The Unit strongly supports the institution's agenda to place diversity and equality at the heart of its work. Staff have supported (e.g. presentation by **Highton**) and made use of the University's Diversity Festival and are made aware of the work conducted by the Equality Forum. Monthly research seminars are also planned to ensure a diverse range of external speakers are invited to present and discuss pertinent issues with staff and students. Research into under-represented groups is also encouraged and supported within the Unit, such as the work by **Moss** supporting the training and nutritional practices of female athletes (e.g. <https://doi.org/10.1123/ijsnem.2019-0037>; <https://doi.org/10.1080/17461391.2020.1788647>) and work by **Bloyce** (with Mead and Powell) examining equality issues in disadvantaged groups ([doi: 10.1080/09581596.2017.1356909](https://doi.org/10.1080/09581596.2017.1356909)).

Postgraduate Research Students

The Unit currently supports 9 FTE postgraduate students distributed between the Applied Sport Sciences and Sociology of PE and Sport research groups. Table 1 illustrates the number of PGR doctoral students that were enrolled in each academic year of the assessment period.

Table 1. FTE of research degree enrolments within the Unit for current REF cycle

	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
FTE (all)	8.41	8.45	10.28	10.19	10.19	8.68	7.00
FTE (doctoral only)	2.98	2.20	5.98	4.42	6.04	3.63	1.51

Consistent with the institution's growth in the number of doctoral students and the Unit's strategy from the last REF period, we have increased the number of PGR completions from 7.5 in 2014 to 18.6 FTE in 2021 (Table 2). The Applied Sports Sciences Research group had 10 PhD completions (**Burt, Connell, Dobbin, Fernandes, Finnigan, Moss, Mullen, Norris, Stanley, Thomson**), one MPhil (**Valentza**) and eight Masters by Research. The Sociology of PE and Sport Research group had 10 PhD completions (**Bicknell, Fry, Haycock, Jones, Law, Lovett, Mead, Scattergood**,

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Wheeler, Wilson). Many of these completions have secured academic posts with a research 'brief' or moved into senior sports performance or health roles within industry. Examples include:

Dr Steven Cock – York St John University
 Dr Nick Dobbin – Manchester Metropolitan University
 Dr John Fernandes – Hartpury University
 Dr John Fry – Myerscough College
 Dr David Haycock – Edge Hill University
 Dr Graeme Law – York St John University
 Dr Emily Lovett – Edge Hill University
 Dr Sam Moss – University of Chester
 Dr Tom Mullen – Manchester Metropolitan University
 Dr Jonathan Norris – Derbyshire County Cricket Club
 Dr Edd Thomson – University of Chester
 Dr Sharon Wheeler – Glyndwr University

A number of taught postgraduate students have also secured funded PhDs at institutions both in the UK (Culvin, Salford University; Phipps, Southampton Solent University; Scanlon, University of Limerick; Williams, Portsmouth University) and abroad (Barrett, Frostberg State University, USA). There are at present 10 students registered at various stages of their doctoral studies and four masters by research.

Table 2. FTE of doctoral level degrees awarded for the Unit

	Y1 FTE	Y2 FTE	Y3 FTE	Y4 FTE	Y5 FTE	Y6 FTE	Y7 FTE
REF2014	0.80	1.00	-	4.00	1.70		
REF2021	3.00	4.00	3.90	1.00	1.00	2.70	3.00

The doctoral degrees awarded, as reported in REF4a, are all PhDs and not research-based professional doctorates.

Postgraduate Research Student Training and Support

Generic and more specific research training and support for PGR students comes largely from the Unit. University-wide sessions are also available via face-to-face and online training sessions, supported by a Moodle site providing on-line access to the *Postgraduate Research Development* training materials. Students receive an induction and within the first three months (six months for part-time students) complete a Research Development Plan and project proposal. Thereafter, students are expected to complete appraisals of skills that are then discussed with their supervisory team to identify relevant training needs and action plans. These are undertaken on a monthly (or bi-monthly for part-time-students) basis with supervisors as part of monthly meetings and, more formally, as part of the Institution's Annual Progress Reviews. The latter are formally documented and held by the Unit and University Registry and revisited on an annual basis to ascertain progress.

At key points within the registration period, and subject to satisfactory progress, students are requested to submit more detailed progress reports on their research that are discussed with independent academics. Where appropriate, students are encouraged to attend taught sessions from within the MSc Applied Sports Sciences and Sociology of Sport curricula. The Unit hosts a series of monthly *Research Seminars* and there is also an annual faculty *Postgraduate Research Student Conference*, both of which provide opportunities for research students to present their work in a supportive academic environment. All students are encouraged annually by the RDO and supervisors to present their work at these events and to attend sessions regularly to develop a broad appreciation of the Unit's research activity and contribute to the research culture of the Unit and Institution more widely. The Unit also holds an annual one-day internal Careers and Research Conference at which PGRs are encouraged to contribute to the organisation and chairing of sessions. Both the Unit and the University make funds available annually to support conference attendance for PGR students.

Students involved in teaching undertake specific training to prepare them and may undertake modules leading to Associate Fellowship of the Higher Education Academy as a basis for future applications for academic posts. Similarly, PGR students are encouraged to participate in co-supervision of undergraduate and taught postgraduate projects alongside supervisors. This helps PGRs develop fundamental supervisor skills, as well as enhance the communication and criticality of the research within their field. This approach facilitates strong undergraduate engagement in research, most notably in those undergraduates who complete an optional research module at Level 5 that postgraduate research students supervise. Based on corresponding data across this REF period, evidence to support this approach is confirmed by the higher proportion of 2:1 or above classifications for a Level 6 Dissertation in those undergraduate students who complete Level 5 research projects compared to those who do not (44.7% cf. 27.5%, respectively). Some 12.6% of the total publications across the last REF period also emerged from undergraduate and taught postgraduate research projects. This approach means the Unit is well positioned in terms of the institutional strategy towards student engagement with research and the development of the citizen student.

Where necessary, research students requiring periods of leave are supported and offered appropriate guidance and planning. On returning from periods of leave (including parental leave) or ill-health, managing long-term illness, or with caring responsibilities, Principal Supervisors are responsible for arranging meetings between the student and supervisory team within one-month. These meetings involve re-visiting the original Research Development Plan and the research project to identify appropriate needs that enable the student to continue with their studies.

Taken together, we believe that the above strategy has, in part, contributed to the improved and high completion PGR rates of the Unit since 2014 compared to the last assessment period.

3. Income, infrastructure and facilities

Income

The Unit's work and partnerships resulted in research income totalling £143,476 (an average of circa £24,000 per year). This income has derived largely from external funders in the form of sporting organisations or governing bodies (e.g. British Athletics, British Cycling, St Helens RFC), with one grant from the Regional Research Council of Norway. While funding is notably lower than that in other disciplines, this is consistent with the broad observations made by the sub-panel after the last REF cycle. The applied work in sport and PE does not attract substantial grant income yet has been the Unit's focus in terms of research and teaching for nearly 20 years. The Unit believe that its decision to remain focused in the aforementioned areas, and thus forgo seeking superior grant capture, is justified in the following terms:

- i. Staff have developed long-standing and fruitful relationships with sporting organisations that enable them to develop sustained and progressive research.
- ii. Staff remain motivated and engaged with research that has direct impact to their teaching, personal scholarly development and impact on the practices of those professionals with whom they collaborate.

The external income secured has been used to support bursaries and fees for PhD students and support ECRs to develop their research capacity. Moreover, the income has been used to support research that has provided direct impact to the funders' operational activities. For example, funding from British Athletics generated an interdisciplinary appraisal of talent development practices that has subsequently informed the structuring of youth talent programme across the Home Nations' athletics governing bodies. Likewise, the funding from the RFL informed a national athlete monitoring programme for all clubs in the UK. This notwithstanding, the Unit acknowledges increasing competitive grant capture is vital for sustained vitality and capacity of the two groups and will therefore be one of the Unit's strategic aims for the next assessment period.

Infrastructure and Facilities

Unit-level environment template (REF5b)

The Unit possesses well-equipped laboratories in physiology, biomechanics, performance analysis and psychology. The University provides a capital allowance for use in the resourcing of research laboratories and makes one-off allowances for updating equipment and special projects. Staff and PGR students in Applied Sports Sciences have privileged access to all laboratories and technicians and sole access (along with research staff) to the dedicated Research Laboratory and its technician. While predominantly for use by the staff and students of Sport and Exercise Sciences, these facilities and the associated expertise have attracted interest from other units across the institution and have facilitated several collaborative projects. For example, work by **Highton** and **Moss** with colleagues in The Department of Computer Science, Electronic and Electrical Engineering (Professor Nigel John, Dr Serban Pop) have developed projects investigating the use of virtual reality on exercise tolerance. Similarly, **Twist** and **Highton** collaborated with The Department of Biological Sciences (Dr Stephen Hughes) for the PhD of **Norris** examining the inflammatory response to high intensity intermittent collision activity. The Sociology of PE and Sport Research group has a 'base' that incorporates a dedicated teaching and seminar space. Both research groups have priority access to two seminar/interview rooms, designed specifically with research in mind.

The unit has two large PhD rooms solely for doctoral students from each research group, in which all PhD students have a separate desk and PC. Externally-funded PhD students also have a lap-top, as do all PhD students in the data collection phase of their projects. PhD students funded through external organisations (e.g. **Fairbank**, **Shergill**) also have a dedicated workspace that is embedded within the partner's working environment and access to support from mentors within their respective organisations, who collaborate frequently with academic supervisors. This ensures the student is supported holistically and is afforded a more rounded development beyond academic supervision. Every member of staff has a separate office and desktop computer as well as a laptop computer.

4. Collaboration and contribution to the research base, economy and society

Background

Staff within the Unit make a meaningful contribution to the field of Sport and Exercise Science, both nationally and internationally. These collaborations and wider contributions to sport and exercise have extended considerably since the REF2014 submission, recognising the Unit's growing status and the relevance of its research to the target audiences. Examples of the Unit's collaborations and research contributions are evidenced by the following examples:

- i. contributions to research and academic networks;
- ii. engagement with research users;
- iii. contributions to the academic discipline; and
- iv. awards and professional recognition.

Contribution to Research and Academic Networks

Twist is a member of the International Rugby Board's (IRB) Science and Rugby Network and the Rugby Football League Scientific Advisory Group. **Green** and **McEvilly** are members of the North-West Counties Physical Education Association for which they edit the *European Physical Education Review*. **Worsfold** sits as an advisor on the English Institute of Sport's scientific advisor panel. **Highton** and **Lamb** are members of the British Association of Sport and Exercise Sciences Sport, Exercise and Health Analytics special interest group. **Moss** is part of a research network with women's soccer.

Engagement with Research Users

Building on the applied research and case studies from REF2014, the Unit has continued to work in collaboration with a number of lead bodies and organisations to offer consultancy and research insight that have informed policy and practice for the end users.

The Applied Sports Sciences Research Group has strengthened its working relationship with leading elite and professional sport organizations. The appointment of **Worsfold** as the Head of Biomechanics with the English Institute of Sport has meant a continued input of the group's insight into Olympic and Paralympic sports. Collaboration exists between academics (at Chester and

Sheffield Hallam University) and elite athletes and high-performance coaches (English Institute of Sport) to develop an understanding of athlete training and adaption into performance. To date, the knowledge has been disseminated through two international conference presentations, two published journal articles and coach, athlete and support staff education.

In terms of applied impact, new and modified training and monitoring methods have been developed and implemented with the GB Track Cycling team to tailor individual specific training protocols. The knowledge has also helped to evolve current methods used within other Olympic and Paralympic sports (i.e. triathlon, athletics) to optimize bespoke training protocols. Similarly, **Highton** and **Twist** have continued their associations with leading rugby league organizations to provide research insight for the likes of the Rugby Football League, St Helens RFC, Warrington Wolves RLFC and Widnes Vikings.

This period has also seen the emergence of previously less experienced academic staff being invited to engage with research users, highlighting further the reputation of the Unit and strength of the work that emanates from within. For example, **Thomson** has developed strong collaborative links with colleagues at GB Boxing to offer expertise in the area of performance analysis. **Moss** has collaborated with colleagues at the Gatorade Sport Science Institute to provide research and consultancy support on the health, well-being and performance of elite female footballers with Arsenal Women and Manchester City Women, as well as input to a partnership project with UEFA ([Together #We Play Strong](#)) supporting youth women's soccer.

Newer developments have also emerged that have highlighted the Unit's internal and external collaborative capacity to undertake integrated research and consultancy. The inter-disciplinary work led by **Twist** with British Cycling has provided support to their national talent development programme, supporting athletes, parents and coaches. Similarly, the inter-disciplinary approach in the work by **Green** (social science) and **Twist** (physical science) with British Athletics provided a comprehensive appraisal of the talent development literature that was subsequently used to inform the governing body's national strategy on talent pathways.

Moss, **Highton** and **Green** have also collaborated with colleagues at Inland University of Applied Sciences, Norway, to work with Birkebeiner organisers targeting both public health and applied sports performance objectives. Academically, our two groups have collaborated nationally with Liverpool John Moores, Sheffield Hallam, Leeds Beckett, Manchester Metropolitan, Hartpury, Northumbria, Edge Hill, Heriot Watt, Liverpool Hope, St Mary's, Nottingham Trent, Winchester and Huddersfield Universities, and internationally with Inland University of Applied Sciences, Norway and the University of Istafan in Iran.

Contribution to the Academic Discipline

Between 2014 and 2020 the Unit has published 135 peer-reviewed papers and also produced 19 book chapters. In addition, **Twist** and **Worsfold** have co-edited the first dedicated scientific text on rugby in *The Science of Rugby* (Routledge), with a second edition having been commissioned and expected for publication in 2021. **Green** has also co-edited *Sport in Scandinavia and the Nordic Countries* (Routledge). With 41% of these outputs produced from student research, 33% have emerged from collaboration efforts with colleagues nationally and internationally.

Several members of the Unit have in the last period been appointed to editorial roles with leading sport and exercise science publications. **Green** (Editor-in-Chief) and **McEvilly** (Editor) lead one of the top-quintile Thomson Reuters journals in education (European Physical Education Review, Sage); **Bloyce** is co-founder and Co-Editor of the International Journal of Sport Policy and Politics (Routledge); and **Twist** is Associate Editor for the Journal of Sports Sciences (Routledge). Twist is an editorial board member for the European Journal of Sports Sciences (Routledge), while he and **Lamb** also serve as board members for Sports (MDPI).

All staff regularly perform peer-review of submissions to a large number of journals. **Twist** is also a member of the British Association of Sports and Exercise Sciences Conference Scientific Committee (2017-2021), while **Lamb** was a member of the BASES Awards Committee (2014-2018). Several

Unit-level environment template (REF5b)

members of staff (**Bloyce, Green, Highton, Lamb, McEvilly, Twist** and **Worsfold**) have regularly been invited to act as external examiners of postgraduate students across the last assessment period, both in the UK and abroad, examining 45 PhD, two MPhil and nine MRes degrees. A further recognition of the Unit is the staff (**Bloyce, Green, Highton, McEvilly, Moss, Thomson, Twist**) who have delivered invited talks both in the UK and abroad (e.g. Japan, Norway, Portugal).

Awards and Professional Recognition

Unit staff have been recognised with awards for their academic and professional contribution to the discipline. **Green** is Visiting Professor at Inland University of Applied Sciences, Norway, and **Twist** (2017) was awarded a Fellowship of BASES. Awards for research have also been secured by staff, with **Twist** winning the Sportesque Award for the best presentation by a senior scientist at the BASES Annual Conference (2017). Taken together, the above provides clear evidence that the Unit has significantly strengthened its contribution and influence on the wider sport and exercise science discipline during the last REF period.

The engagements by staff in a range of activities and roles ensures a meaningful contribution to the Unit's sustainability and, more importantly, an enrichment of the research environment for its staff and students. In particular, the growth and strengthening of contributions to the wider sport and exercise science academic agenda by those members of the Applied Sport Sciences group over the last period have combined with the more established Sociology of Sport's long-standing contributions. The described achievements clearly reflect a maturing of the overall research culture and a continuing upward trajectory of the Unit from previous assessments.