

<p>Institution: University of the West of Scotland - Institute for Clinical Exercise & Health Science</p> <p>Unit of Assessment: UoA26</p> <p>1. Overview</p> <p>UWS has not previously submitted to this Unit of Assessment. Nevertheless UWS has history of successful taught programmes in Sport and Exercise Science. In 2008 the need for a stronger research base in this area was highlighted and hence investment in both staff and facilities was greatly increased, particularly in the Sport Science area. Thus, since 2008, as detailed below, the University has recruited 9 new academic staff (8.2 FTE) and 2 support staff in this area, supported the development of the research capabilities of existing staff, and enhanced the research environment through funded Studentships and improved infrastructure. This strategic investment is an ongoing process and will be further strengthened by a recently announced £50million further development of the UWS Hamilton campus (where our Sport provision is located).</p> <p>The overarching structure underpinning research here is the UWS Institute for Clinical Exercise & Health Science (ICEHS); the Institute staff research the anatomical, physiological, biomechanical, and bio-behavioural aspects of exercise and physical activity – including sport – as they relate to the national health agenda. Within this Institute there are two underpinning pillars:</p> <ol style="list-style-type: none"> (1) The Centre for Clinical Exercise & Rehabilitation Science is currently researching into; metabolic disease, cardiopulmonary disease, immune function, oxidative stress, steroid abuse/misuse, whole-body vibration as an exercise intervention, hormonal control of exercise, health promotion, exercise as an element of breast cancer survival, anthropometric variation in children, spinal biomechanics and gait analysis. (2) The Sport Academy is presently examining how the anatomical variability of the human body affects weighted exercise movements and how this, in turn, informs the teaching of such skills. The Academy explores the effects of Rugby 7s training and competition on metabolic and performance markers of physiological recovery and readiness, determining how cerebral insult in sport affects biochemical markers of cognition, and investigating the evolution of sport within Scotland and the impact of the Glasgow 2014 Commonwealth Games. <p>Clinical exercise, health and sport research has undergone transformational change at UWS resulting in a vibrant and academically rich research environment, with ten staff (9.2 FTE) included in the current REF submission, with others working towards inclusion in any future submission.</p> <p>2. Research strategy</p> <p>The UWS strategic aim here is to produce world-leading research that generates new insights and practice in Sport Science, responds to the health challenges of the communities we work with, and underpins and informs our taught portfolio. To achieve this aim, and build on existing provision, the university recruited Professor Baker in 2009 to provide new academic leadership in this area and supported him in designing a 5-year plan that would develop the research culture and agenda, through the establishment of a research institute that would both, serve as an incubator for developing previously research-inactive academic staff, and also harness the expertise of new, carefully selected, high calibre research staff with the necessary skills to meet strategic requirements. This approach is entirely compatible with the Concordat on Career Development for Researchers and has already had significant impact on research productivity as shown below.</p> <p>In line with this plan, UWS has recruited 3 new Professors, 1 Senior Lecturer and 4 Lecturers into this area since 2009, bringing the total number of academic staff to 24, and has completed a £580,000 laboratory refurbishment and equipment investment programme. This has culminated in the formal establishment of the Institute (ICEHS) which is measured against a set of pre-determined targets, designed to measure three key Performance Indicators namely; total amounts of external income, total numbers of quality research papers, total numbers of PhD studentships, plus a drive to fully include all members of academic staff in research activity and knowledge exchange (as now required by UWS policy). ICEHS is steered through a Project Board which draws upon Senior Research Staff (with Professor Baker as Director of the Institute) and includes UWS staff from the Innovation & Research Office (IRO) and Finance Office who provide business and financial support. The Project Board reports through the Faculty of Science & Technology to the University Research & Knowledge Exchange Board.</p> <p>A key strategic priority of the Institute is to contribute to the University's mission; to have a transformational influence on the economic, social and wellbeing of the regions in which the University (multi-campus/multi region) operates. This is coupled with key challenges facing</p>

Scotland in poor health, obesity and lack of fitness in children as well as adults. The Institute aims to address these challenges through targeted, applied research working with strategic partners and stakeholders. Many Postgraduate Research Student (PGR) projects also run in partnership with external organisations such as the NHS, Local Authorities Charities and local schools. The Institute aims to create a body of scientific evidence that contributes to the following objectives:

1. Promotion of public health through physical activity, exercise and sport.
2. Informing health, fitness and sport professionals/participants in safe, effective, and sustainable practice.

The Centre for Clinical Exercise & Rehabilitation Science – The academic staff of this Centre collaborate in research into the benefits of the clinical effects of exercise, both as a prophylactic and as a therapy. The staff are active in the areas of cardiac physiology and rehabilitation, pulmonary physiology and rehabilitation, paediatric health and exercise, workplace ergonomics, community health and physical activity interventions. The Centre has several unique laboratories capable of measuring virtually any relevant variable: Applied Physiology Laboratory, 3D Ultrasound Laboratory, Haematology Laboratory, and the Biochemistry, Physiology, Sport Physiotherapy & Rehabilitation Laboratory, and Biomechanics Laboratories shared with the Sport Academy. One of the major foci, and indeed a central theme of research, is scientific investigation related to paediatric physical activity and health. Staff regularly engage in collaboration with academics from the UK, EU, Asia, Australia, Canada and the USA. Staff include three professors with exceptional credentials; Professor **Baker**, a DSc with well over 250 publications; Professor **Wagner** with over 300 publications; and Professor **Vogiatzis** with over 60 publications. The latter two are world renowned pulmonary physiologists and editors for the Journal of Applied Physiology. Collaboration between **Wagner** and **Vogiatzis** has focused on developing technical expertise to assess respiratory and locomotor muscle blood flow during exercise in both healthy and diseased populations of varying ages and genders. They are currently working on validating a state-of-the-art method to study heterogeneity of local muscle perfusion to metabolism. The other research members of the Centre have additional and complementary research skills that allow an holistic examination of exercise in healthy and diseased populations.

The Sport Academy – The UK government and National Governing Bodies of Sport have a stated interest in higher education through their whole sport plans that intend to engage students through intramural and social sporting opportunities. Further, the UK government and the NHS strongly assert the link between sport participation, health, and wellness. Within the Sport Academy there are three interrelated areas of research; (1) coaching improvement, to include fitness enhancement methods, (2) psychological & sociological aspects of participation, and (3) commercial aspects of health and fitness operations. Within the Sport Academy research staff, there are five national/international level coaches (Adams, **Baker**, Graham, Kilgore, Mason), two behavioural specialists (Graham, McEwan), and two staff with extensive experience within the commercial fitness sector (Adams, Kilgore). In addition, Dr **Whyte** studies the physiological effects of exercise, looking particularly at fatigue and recovery profiles. Professors **Baker** and Kilgore and Lecturer Adams have competed as internationally ranked athletes. Lecturers Graham and McEwan have competed in sports to the national level. Professor Kilgore co-authored three of the leading books on strength training and fitness globally (Starting Strength, Practical Programming for Strength Training and FIT) and was the author and illustrator for a discipline specific anatomy textbook (Anatomy without a Scalpel). The subject chosen for primary emphasis and investigation within the academy is the creation of training methods that coaches may use to enhance performance within the athletic community. One of the related focus areas is high intensity exercise (strength training, interval training, and multi-element fitness training). Another area of interest is the analysis and shaping of coaching behaviours that create more athlete-centred sport environments. Finally, current research encompasses the understanding of balancing market pressures, government initiatives, and consumer habits in pursuit of a more active public.

The overarching Institute follows an impact plan that comprises five elements; (1) Collaboration with Government and Sporting Bodies (2) Publication in high impact factor appropriate journals (3) Publication in practitioner and professional journals and (4) Engagement in academic and lay conferences (5) Publication of books and book chapters. In this way research findings are being disseminated to the widest possible audience and potential impacts are optimised.

Over the period of the strategic plan, there has been significant drive to attract external funding

Environment template (REF5)

that both supports the Institute's activities and recruits new partners in joint research and Knowledge Exchange. This is illustrated in the progression statistics below:

% of Staff Submitting Applications

2008/09	2009/10	2010/11	2011/12	2012/13
14%	27%	31%	58%	68%

The progression of funding activity has resulted in a number of small to moderate size awards from granting agencies and knowledge transfer grants:

Research/Knowledge Transfer Awards

<u>2008/09</u>	<u>2009/10</u>	<u>2010/11</u>	<u>2011/12</u>	<u>2012/13</u>
£2,315 (1 award)	£28,900 (4)	£30,280 (4)	£128,000 (9)	£160,000 (12)

The figures above show the impact of recent research staff recruitment and the establishment of the Institute and it is worth noting that there are over £600k of outstanding research grant applications pending which were submitted in AY 2012/13. Similarly, scholarly activity across all 24 Institute staff members has greatly increased:

2009 – 14% Staff Scholarly Active, 14% Grant Application Active, 7% with 4 papers in 5 years
 2010 – 20% Staff Scholarly Active, 27% Grant Application Active, 13% with 4 papers in 5 years
 2011 – 38% Staff Scholarly Active, 31% Grant Application Active, 19% with 4 papers in 5 years
 2012 – 79% Staff Scholarly Active, 58% Grant Application Active, 47% with 4 papers in 5 years
 2013 – 86% Staff Scholarly Active, 68% Grant Application Active, 59% with 4 papers in 5 years*
 (*new researchers with two papers also included)

3.1. Staffing Strategy

In accordance with UWS strategy and aligned with the development plan, the recruitment strategy included selection of key specialist researchers to align with the development plans for the Centre. In addition, two support staff (Administrator Hamilton; Technician Chatzis, MSc) have also been recruited.

Nine research active staff (eight from new appointments and one from internal transfer) have been added in support of defined areas of research within the new Institute: Kilgore, **Vogiatzis**, **Wagner**, **Sculthorpe**, **Easton**, Sanderson, **Whyte**, Watson, and **Ugbolue**.

Two notable recent additions to the research staff specifically added to develop the pulmonary aspect of the Institute's activity are; (1) Professor **Wagner** arguably the leading researcher in the field and Chief Editor of the Journal of Applied Physiology and (2) Professor **Vogiatzis** another internationally recognized pulmonary physiologist and member of the Editorial Board of the Journal of Applied Physiology. Professor **Vogiatzis** has developed the Pulmonary Consortium; a problem based working group between the Institute and three NHS hospitals. Coupled with the work of Dr **Sculthorpe**, a cardiovascular imaging specialist, these staff will significantly contribute to the Institute's international collaborations, research mentorship capacity and grant applications. Another key feature of the Institute's research has been work examining repeated bouts of intense exercise, with changing frequency, intensity and recovery periods and its effects on markers of health and fitness, particularly in youth populations. This describes the critical relationship between physical fitness, physical activity, CVD risk factors, overweight and obesity. On-going collaborative research in secondary schools in Scotland, Wales, India and the USA has created an ideal setting to investigate and practice the health-promoting activities that effect future behaviours of our children. Professor Kilgore, an internationally recognised expert in fitness adaptation and fitness instruction, was recruited to drive forward the strengthening research agenda within the Sport Academy.

Early stage career development

As stated in Section 2 “Research Strategy”, ICEHS ensures that all staff are fully involved in research and KE activity. There are currently 9 members of staff undertaking PhDs as part of their staff development. These staff, who were not formerly research active, are being mentored by experienced staff which has facilitated involvement in research. Similarly 30% of staff have been successfully involved in Scottish Funding Council Innovation Voucher Scheme projects as part of their journey towards research competency.

Since 2009, early career researchers have been nurtured through their designated research cluster and, since 2012, ICEHS, which provides a range of support measures. These include: developmental support through a PhD or other appropriate qualification; enrolment onto the PgCert in Research Supervision to develop supervisory capacity; mentoring to support academic publishing or grant application; peer review of major and all first grant applications; access to the UWS research training programme including credit bearing modules in Research Methods and a wide range of short courses; access to conference attendance funds and research development funds via ICEHS; dedicated Early Career Research Development and Knowledge Exchange Development programmes with on-going after-care and peer support for staff development; and tailored grant assistance including support to identify funders and dedicated support through First Grant Schemes.

Thirteen out of the staff complement of twenty-four are early career researchers and each have benefitted from the UWS academic development programme. Where appropriate, they are also prioritised to receive internal funds to supervise a PGR student as part of an orientation package. Each also receives tailored induction and support from the Innovation and Research Office (IRO) to facilitate engagement into their research institute and to foster their research and engage in knowledge exchange.

Equal opportunities

The University values and recognises the benefits of a diverse and multicultural community and is committed to ensuring equality of opportunity for all staff. We are proud of our reputation for widening access to Higher Education from all sectors of the community and of our record in attracting students from under represented socio-economic backgrounds. The University will, through the development of the Equality Outcomes and other Equality, Diversity and Human Rights strategies and policies set out to respect and celebrate diversity because of its value in attracting, motivating and retaining students and staff; its contribution to the enrichment of the intellectual environment and of the learning experience for students, and its contribution to the pursuit of equality in the wider community. UWS is committed to achieving Athena SWAN accreditation by the end of year 2014 and is focused particularly on using mentoring, focus groups and champions to identify and remove any unfair barriers to progression.

The University has a flexible working policy which aims to meet both the needs of employees and the requirements of schools and departments in terms of service delivery. The University also has a policy for engagement with non-permanent staff, which aims to ensure appropriate, transparent and consistent recruitment process is followed. The effect of this policy is evidenced in our staff population. The Institute’s staffing profile includes 24 staff including; 5 Professors, 1 Reader, 2 Senior Lecturers and 16 Lecturers. Of these, almost 20% are from out with the UK and 40% are female (including Professor **Lewitt**).

3.2. Staff Development

It is important to note that the full membership requirement, within any part of the Institute for Clinical Exercise & Health Science, is predicated upon producing four papers within the preceding five year period (two papers for new researchers) and producing at least one research/knowledge transfer funding application. Having well described and objective standards of membership provides targets for professional development and activity planning within each individuals teaching, research, and service responsibilities. The university has a standard workload allocation model that allocates time for research based on previous performance and agreed forward

objectives. For example, there are currently 9 Institute staff members who are registered for PhDs as part of their ongoing staff development and have time allocated within their workloads to achieve this. Further, there is a mentorship programme, supported by the Institute that matches new researchers with experienced researchers as a support and development mechanism. The UWS Innovation & Research Office also provides developmental seminars and workshops for new researchers that cover authorship, ethics, funding, and research organizational skills.

ICEHS follows a publication impact plan that is comprised of three elements. (1) Publication in Impact Factor appropriate journals. For newly active staff, journal impact factors are less important and where appropriate, open access journals are targeted. Wide access to outputs and publication experience in the first instance is considered more important at this career stage than impact factors. However, high quality peer reviewed journals with higher impact factors are sought wherever possible. (2) For active researchers, with more than four publications, publication in the higher quality journals is, of course, expected. Also, translating research into forms that can be consumed by exercise and sport professionals is an important aspect of institute activities. Research journals inform other scientists and as such findings must be delivered in topical reviews, professional position statements, or clinical applications papers that are included in professional journals or government documents. The work of ICEHS also has a direct impact on exercising populations. Staff are encouraged to write papers targeted specifically at people who have no formal training in science, but can benefit from research information in terms of improving the effectiveness and safety of the exercise or sports in which they participate. (3) Publication of books and book chapters.

4. Research Students

The growth of the Institute via progressive addition of staff since 2009 has enabled a steady expansion of PhD student numbers studying in the Institute. The numbers of PhD students has grown from 2 in 2009 to 31 in 2013.

The University has a Graduate School that monitors and supports student progression and encourages engagement between students and with external Graduate Schools and organisations. The Graduate School also offers a rich training programme for research students and there are University-wide policies designed to ensure monitoring of progress. The University runs an annual research student conference and poster competition, where all 2nd and 3rd years present; this attracts significant external sponsorship and engagement from business, industry and the public sector. All students are supervised by a team, of which an experienced Director of Studies has the primary lead, with additional academic oversight through the University Research Degrees Committee and administrative support from IRO and the UWS Graduate School. All research students undertake annual review and panel meetings to oversee progress and may undertake a module within our PGCert in Learning and Teaching. Supervisors are also required to take a training course. Students are given opportunities to teach within taught programmes, and can also provide additional paid support to key research project initiatives.

Five students who began study in 2009 have successfully completed, prior to December 2013, and all have positions in higher education (4 in Scotland, 1 in England). Presently there are 31 full and part-time PhD students supervised by Institute staff. Notable within this number is that seven of them are fully funded positions (2 NHS, 1 WRU, 1 Glasgow Life, 1 UK-India Programme, 1 Libyan Government, 1 Multiple Sclerosis Society). These students benefit greatly from the exposure they are given to the external environment. For example, with the Welsh Rugby union where students have been taken on tour with National Rugby squads to conduct scientific measurements related to the performance of the athletes as part of their PhD. The involvement of external funding organisations, and the “real life” environments that they give access to, is seen as a vital component in enriching the research student experience for all current PhD students. Similarly, there are 11 UWS staff members studying PhDs through the Institute (9 from the Institute as staff development and 1 each from Business and Life Science) which brings a level of experience and maturity to the research student pool and is carried through into research discussions, meetings and seminars. Finally, all PhD students are expected to be involved in teaching and Knowledge Exchange activity which, in the latter case, has involved students assisting in small projects such as Scottish Funding Council Innovation Voucher Scheme studies with local Small to Medium sized Enterprises (SMEs). The average publication output of full-time PhD students is 1 paper per year prior to sitting their viva voce.

5. Income, Infrastructure & Facilities

5.1. Income

The Institute for Clinical Exercise and Health Science has been operating since July 2012. The Institute has been established as a UWS project, managed using Prince 2 project management principles, with an identified Project Manager working alongside the Academic team to run the project. Key performance indicators relating to the establishment of the Institute have been developed which specifically include driving up the Institute's levels of non funding council income from 4% in AY 2011/12 to 34% in AY 2013/14.

The income figure for the REF Period was £138k from 12 awards, which exceeded the planned target. However, it is worth noting that this included 29 funding applications, totalling £1.2m, submitted to various funders (Wellcome Trust, EPSRC, NIHR, WADA, Carnegie Trust, CSO, Leverhulme, NHS) and several local councils. The value of outstanding pending applications is £675k. Professor **Vogiatzis** has an exemplary history of funded research with approximately £1.7m received by the European Research Directorate (IMI–JU and ICT research frameworks) and the pharmaceutical industry (Pfizer & Boehringer Ingelheim) since 2008 to carry out research in the area of rehabilitation and chronic care for patients with lung and heart disease. It is apparent that a significant number of staff are heavily engaged in grant applications and knowledge exchange. This is an ongoing expectation for all staff.

Other in-kind Research Funds - The Institute Director has been extremely successful in obtaining in-kind contributions to the research activities of the Group with the value of such contributions totalling £513k.

In preparing the Institute's business plan, the Project Team completed an analysis of potential sources of funding and identified key areas for potential exploitation. Chief amongst those was, obviously, increased external research funding however; in order to develop sustainability, additional commercial revenue streams based on the skills and expertise of the staff were created and added to the Institute's portfolio. Revenue from newly developed distance learning courses was deemed to be a key component of the sustainability strategy. In this way, potentially high volumes of non SFC funded distance learning income could be used to support and sustain the developing research plan. The key Institute, non-research, revenue streams are as follows;

(1) Distance Learning - This Institute has developed a unique approach to acquiring funds to support its research activities. A fully online Certificate in Higher Education in Professional Fitness Practice has been developed from the works of the senior Institute staff. The programme, led by Professor Lon Kilgore, is specifically marketed to international students and the revenues from the programme are classified as commercial revenues with a significant portion of the net funds returned to the Institute to serve as research support funds. It is anticipated that beginning in February 2014 this method of funds acquisition will deliver £25,000 – £100,000 p.a.

(2) Physiotherapy Provision - A Sport Physiotherapy & Rehabilitation Centre was opened where our two chartered physiotherapy staff (Dr. Mark Sanderson & Mr. Colin Brow) offer their services in order to create revenues to support research within their domain. It is anticipated that approximately £5,000 per year of funds will be received through this pathway.

(3) Contract Facility Use - The Strength & Conditioning Laboratory is presently under compensated contract for use by professional sports teams. This line of revenue acquisition is anticipated to generate a modest amount of funds. However, the presence of elite level athletes and coaches in residence creates an experimental subject pool of great value with obvious intangible benefits.

5.2. Infrastructure

The Institute was created as two functional pillars, the Centre for Clinical Exercise & Rehabilitation Science and the Sport Academy. The rationale for this particular division stems from the dichotomy of research within the career fields within the discipline. The former centre serves directly health and clinical topics of research and the latter academy investigates topics specifically applicable to sport and fitness (both performance and instructional aspects). Such delineation allows for efficient planning for staffing, equipment and resources along with transparent framing of potential internal research relationships.

The Institute has an executive oversight group (the Project Board) consisting of the Faculty Lead for Research and KE, the Head of School of Science, a Finance representative, an Innovation & Research Officer, Professor **Baker**, Professor Kilgore, and Dr. **Grace**. Daily operational and

strategic decisions regarding the Institute are carried out by the Management group consisting of Professors **Baker**, Kilgore, **Vogiatzis**, Reader **Grace**, and Senior Lecturers **Buchan** and **Sculthorpe**.

5.3. Facilities

The Institute for Clinical Exercise & Health Science occupies a large footprint in the Almada Building on the Hamilton campus of UWS that has benefitted from a recent £580,000 renovation. Laboratories present include;

Ground Floor – Biomechanics Laboratory, Strength & Conditioning Laboratories (3 room suite), Sport Physiotherapy & Rehabilitation Laboratory (3 room suite), Behavioural Laboratory, Sport Barn

Second Floor – Exercise Biochemistry Laboratories (3 room suite)

Fourth Floor – Human Performance Laboratory, EMG & Ultrasound Laboratory

Fifth Floor – HPLC Laboratory

Staff and PhD students are housed in offices dedicated to the academic and research staff in the discipline. All administrative and technical support staff are located in close proximity to research staff. As previously stated, UWS is currently planning a £50m investment at the Hamilton campus and the Institute will benefit further from this investment.

6. Collaboration or contribution to the discipline or research base
Contributions

There are numerous examples of Institute staff contributing to the discipline through their research outputs. Body Mass Index (BMI) is used in virtually every health related profession as a marker of obesity and health status. Recent work by Professor **Baker** and Professor **Lewitt** (UWS School of Health) demonstrated that BMI was NOT an accurate assessment of obesity in children and that visceral adiposity is a more relevant marker of health. This is closely aligned with the works of Institute staff **Baker**, **Buchan**, and Ollis who have identified previously undocumented health effects, relative to diet and inactivity, in adolescents of Asian descent. Other interesting contributions from staff include that of Professor Kilgore who is working to create a unique body of evidence exploring human anatomy in reference to health and fitness. He published the first article ever to examine differing anatomical feature alignments upon production of safe and efficient weighted exercise movement. This is unique, as other researchers have only described the movement of the load or selected joints during movement. Additional areas of influence from the Institute includes anabolic steroid metabolism and side-effects, the domain of Dr. **Grace** and Dr. **Sculthorpe**, vertebral health, a publication area of Dr. **Ugbolue** and Mr. Watson, and dietary supplementation as presented by Dr. **Easton**.

The current strategy for collaborative working with key partners will be continued and developed over the next few years. Collaboration and external funding will continue to be key to the strategy (for example, the Institute is developing a strategy for Horizon 2020). Some specific examples are:

1. WADA – Examination of the effects of Human Growth Hormone abuse.
2. WRU – A multi-year descriptive study of the Welsh 7s National team in training and competition (including the 2014 Commonwealth Games).
3. Chief Scientific Officer for Scotland – A continuation of the effects of High Intensity exercise on school population health.
4. NHS Scotland – Two active multi-year projects: (1) education interventions for health of school aged children, (2) effects of exercise on recovery of breast cancer patients post-therapy.

Research Networks & International Collaborations – Representative examples are:

UK	USA	Ireland
University of Ulster	University of Houston	University of Dublin
Imperial College London	Midwestern State University	France
University of South Wales	Indiana University of Pennsylvania	University of Blaise-Pascal
University of Swansea	Brookhaven College	University of Lille
Oxford University	Other	Hong Kong
St. Andrews University	Australian Institute of Sport	Hong Kong University
University of Glasgow	United States Olympic Committee	Hong Kong Baptist University