

<b>Institution: Liverpool Hope University</b>
<b>Unit of Assessment: Unit A6 (Agriculture, Food and Veterinary Sciences)</b>
<b>1. Unit context and structure, research and impact strategy</b>

### ***Unit Context***

Liverpool Hope University (LHU) is a vibrant, liberal arts inspired institute, which since 2005 has had an emphasis on repositioning itself in part through the strengthening of its research focus and by nurturing and celebrating enquiry. This has been achieved through several research environment associated endeavours. These have considerably improved the profile of LHU and will be outlined in this document. It is the aim of the institute to continue this mission with a view to becoming a natural epicentre for research. The aims of this particular Unit of Assessment (UoA) are to mirror those of the overall institute. This is the first UoA regarding Agriculture, Food and Veterinary Sciences submitted by LHU.

This is a very small UoA consisting of seven (6.6 FTE) staff (Dr Leo Stevenson, Dr Farzad Amirabdollahian, Dr Rosanna Cousins, Dr Richard Webb, Dr Grace Farhat, Dr Peppy Emeagi, Dr Claire MacDonald-Clarke), four of whom have joined the team within the last three years (Dr's Stevenson, Webb, Farhat and Emeagi). The core of the team is comprised of five Nutritionists (4.6 FTE) who are all registered with the UK Voluntary Register of Nutritionists. The register is governed by the Association for Nutrition, whose purpose is to protect the public and assure the credibility of nutrition as a responsible profession. The two members of staff who are not registered Nutritionists are Dr Emeagi and Dr Cousins, a biologist and a health psychologist respectively, who bring a complementary range of expertise to the team. Furthermore, a sizable proportion of the team is comprised of early career researchers (four people, 3.6 FTE) and one member of staff (0.6 FTE) is currently taking a two-year career break. This core team forms the Nutrition department, which sits within the School of Health Sciences at LHU. This submission consists of 17 selected research outputs and two impact case studies.

Since REF2014 LHU has undergone extensive changes, in terms of both staffing and facilities. This has been the result of the University investing heavily in capital infrastructure, spending approximately £14 million, which was invested entirely from its own funds. A key example of this being a new £8.5 million Health Sciences building where the Nutrition department is based, which was opened in 2016, providing a forum for research engagement, where diverse disciplines including Nutrition, Biosciences, Sports and

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Exercise Science and Psychology intersect and collaborate. This building also contains several facilities from which the UoA directly benefit, which are referred to later in this document (see section 3).

More specifically, the research interests directly related to the UoA can broadly be defined into two principal themes:

1) **Healthy Aging:** This theme draws from multiple disciplines, including Nutrition, Sports and Exercise Science and Psychology. The research performed under this theme has been undertaken with a view to enable the attainment and maintenance of optimal health over the lifespan and to have a large user/beneficiary focus.

and

2) **Health of Young Adults:** This theme also draws from the disciplines of Nutrition, Sports and Exercise Science and Health. In the UoA two research projects have been carried out in succession to assess the diet, physical activity, and mental health of young adults with a view to creating a positive impact upon their cardiometabolic health.

The establishment and refinement of research capability in these areas has been extremely exciting and fruitful. It is also heartening to recognise the drawing together of individuals, predominantly from the Nutrition department, who were otherwise operating separately and the recruitment of new members of staff from other departments to create capability. That said, it must be emphasised that it is only the first step of a longer journey and a wider strategy to increase the research profile of LHM (details of which will be described later in this section under the heading 'Future Strategic Aims and Goals').

**Research Strategy**

In line with the University's overarching research strategy for 2015-2021, our aims are sixfold: 1) To improve the research culture, 2) To increase research income, 3) To increase postgraduate numbers, completions, and experience, 4) To maximise research impact, 5) To strengthen leadership, 6) To maintain research integrity.

The School has recently formed a Research Committee who are now responsible for the overarching strategy. However, it is important to note that the research strategy specifically pertaining to the UoA is more heavily weighted towards improving the research culture, to increasing research income and to improving postgraduate numbers, with a view to creating research '*momentum*'. Since 2014 significant investment by the University in the physical

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infrastructure has improved the tangible research environment and staff profile to provide the manpower required to produce high quality research. Indeed, in REF2014, Quality Related (QR) funding was quadrupled from the 2008 exercise and all of this was invested back into research at a Unit level (which contributed towards this first REF submission by the UoA). Furthermore, several small internal grants have also been awarded at Unit level, specifically to attend conferences, obtain impact evidence, produce staff development workshops and seminars and to procure specialist equipment and software, with a view to facilitating pump-priming activity and stimulating growth.

Highlights of achievements since REF2014 are shown below in the light of the six aims previously described:

1) To improve the research culture: Building a £8.5 million Health Sciences building to act as a hub for research excellence in the Health Sciences at LHU has contributed towards this, by predominantly enabling better interactions between colleagues. Similarly, the strategic employment of several staff members to improve research productivity within the UoA and being awarded several small research grants to assist with the procurement of research impact data and to improve the research environment have also contributed. We have also developed subject-specific research seminar events where excellent researchers from external institutes have been invited to share their expertise with staff and students at LHU. We are particularly pleased to report that these events have continued through the last few years, even throughout the COVID pandemic.

2) To increase research income: Several external grants with the sum values of over half a million pounds have been submitted by the UoA to increase research income. These grants have yet to be successful, however there are some 'grants in kind' from industrial collaborators received; for example, from an indirect calorimetry instrument manufacturer loaned and then donated the equipment with a view to validating their product.

3) To increase postgraduate numbers, rate of completion and experience: After an open call for high-quality research projects, three Vice-Chancellor's Scholarship awards were awarded to the UoA with a view to increasing the number of high-calibre postgraduate research students (PGR) within the unit. Furthermore, the introduction of a new MRes in Food and Nutritional Sciences in 2019 has already improved the number of postgraduate students in the UoA from four to eight in total.

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4) To maximise research impact: The UoA has decided to focus on a small number of research areas (i.e. 'Healthy Aging' and 'Health of Young People') with a view to improving the impact of research through a more refined approach with a focus on appropriate external links.

5) To strengthen leadership: An example being our recently developed MRes programme, which gives staff members a valuable opportunity to supervise postgraduate students and to improve their own leadership skills.

6) To maintain research integrity: Developing a series of staff development sessions to improve the quality and consistency of research and through the incorporation of the Vitae Researcher Development framework into the studies of PGR students to better ensure that good research integrity is recognised and maintained.

***Future Strategic Aims and Goals***

Over the next five years staff submitted to the UoA plan to build upon the accomplishments described above by contributing towards a range of objectives within the framework of our two principal research themes of 'Healthy Aging' and the 'Health of Young Adults'. These objectives are shown below:

- To further investigate how optimal health through aging and for young adults might be achieved by mapping current and previous research undertaken by the UoA in this area against other departments in the University. For example, with the School of Social Sciences where colleagues are currently investigating themes of young adults and healthy aging from sociological perspectives. By doing this it is hoped that new synergies may be realised to increase research scope and impact.
- To improve our likelihood of obtaining internal and external funding to facilitate the production of high-quality research through the introduction of grant writing workshops, applying to a more diverse range of funding sources and by increasing collaborations, both internally and externally.
- To further develop the research environment through the additional development of staff members and PGR students, in the form of expanding upon our current portfolio of development workshops and training, as well as offering more leadership opportunities to staff members.

***Impact Strategy***

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The importance of impactful research is recognised by LHU and the institution has given significant attention to this throughout its Research and Scholarship Development Plan. The University aims to align with the REF's definition of impact, whilst supporting other research activities (that may be valuable in their own right and) which contribute towards the institution's commitment to public engagement and contribution.

Similarly, at a Unit level, the creation and documenting of impact regarding our principal research themes has aimed to complement these broader institutional goals. This has been achieved through the development of a range of outreach activities, such the facilitation of community engagement seminars for older adults centred around healthy aging and events to promote cooking skills in young people (these are described in more detail in the relevant impact case studies). These activities also link with the strong end-user focus of our two principal research themes.

Furthermore, with regards to research integrity, the University is actively working towards establishing an open research environment, where internal and external collaboration and outreach is encouraged. The University is also a signatory of the Concordant to Support Research Integrity and has demonstrated its commitment to taking its open access requirements seriously by producing the 'Hope Institutional Research Archive' for all research output produced by academic staff to be held. It is also noteworthy that all work submitted to this particular UoA meets the requirements of availability via an institutional repository, within the timeframe allocated by the REF. Furthermore, the University has also established its own research ethics committee which ensures good research practice across the institute. The UoA adheres to these aspects, and also has its own School-specific research ethics committee which serves the UoA to ensure that all research is scrutinised by knowledgeable and capable committee members.

The strategy for the UoA moving forward is to build upon these foundations and to work further towards promoting an open community by encouraging staff to publish articles via open access, as well as openly publishing datasets. Furthermore, actively engaging with beneficiaries of our research is regarded as an important marker of impact specifically for our UoA and we would like to further capitalise upon this in future to increase the value of our findings. We have already started preliminary talks with organisations involved in Healthy Aging, such as Age UK and Abbott Nutrition, with a view to collaborating on research projects. Furthermore, there has also been advanced discussions with an organisation called Crossroads Care Northwest, who deliver home-based care to elderly people still living at home, with the intension of developing collaborative research regarding the nutritional

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status of this particular group of individuals. Links have also been established with key individuals involved regionally with supporting NIHR (National Institute of Health Research) bids. Again, this is linked to research relevant to supporting aging populations in the context of NHS priorities in this area) and we are aiming to strengthen relationships such as these over the coming years.

**2. People*****Staffing Strategy***

Since REF2014 LHU has undergone significant developments in terms of staff investment. This has been in line with the University's 'Our People 2020' strategy, which aims to employ fully engaged new staff members and retain existing staff with the appropriate skills, attitude, behaviours, and professionalism required in the increasingly competitive world of higher education. More broadly, it also aims to create effective compliance and performance frameworks, staff development programmes and define academic standards related to recruitment and promotion activities, reflecting the maturity of the institution and the aims of the corporate plan.

The UoA is no exception to this and has recruited four members of staff (4.0 FTE) to the Nutrition department over the past three years (Dr Grace Farhat, Dr Richard Webb, Dr Peppy Emeagi and Dr Leo Stevenson). Each of these individuals has been employed in part because of their ability to contribute towards research and to directly improve the research environment. For instance, recruitment actively targeted individuals to enhance research capability in the areas of Healthy Aging and Health of Young Adults themes, with Drs Farhat, Webb and Emeagi being employed as early career researchers able to offer expertise in clinical nutrition and biology relevant to both themes and Dr Stevenson as a Senior Lecturer with a long-established research career which has more recently focused on the elderly. These have been strategic decisions, made with a view to building and reinforcing expertise in these areas and to increase the capacity of the UoA to ultimately do more, better research and have a greater impact.

Since the last REF the University has introduced a series of Vice-Chancellor's Scholarship awards. These awards have enabled four Postgraduate Research (PGR) students to pursue PhDs in the UoA. All students have now successfully completed their PhDs (100% success rate) and each has produced a range of research outputs which have contributed towards the research performance of the UoA. Two of these individuals (Dr Kate Mooney and Dr

**Unit-level environment template (REF5b)**

Luke O'Brien) have gone on to gain full-time employment working for charitable organisations within the field of Nutrition and the third (Dr Ben Kirk) has achieved a postdoctoral position at the University of Melbourne, Australia, continuing his research investigating nutrition in elderly populations.

Furthermore, last year LHU has introduced, for the first time, an MRes in Food and Nutritional Sciences. This course has recruited x4 postgraduate students who are all currently conducting a range of short research projects, ranging from food analysis to clinical nutrition. These projects each augment the research profiles of individual staff members and embedding this research expertise into a relevant skilled workforce, thus contributing towards a pathway to impact. It is hoped that in future years the UoA can grow upon this small initial foundation to ensure the sustainability of this pipeline of PGR students, which is contributing towards the research environment.

***Staff Development***

Since the last REF Liverpool Hope University has spent a significant amount of time building a dynamic and supportive working environment that values staff and PGR students at all career stages. The UoA currently has seven (6.6 FTE) members of staff, all of whom are research active, together with 1 FTE administrator and 1 FTE Laboratory Technician.

Since 2014 average staff numbers have not greatly changed in the overall department, nor has there been any real change in the profile of BAME members (as the department has historically been diverse). There has been staff turnover with individuals joining other institutes, pivoting to roles in industry, or pursuing a change of career, however this has recently been accompanied by a more specific and focused recruitment strategy. This strategy has been in part to create a sense of belonging in the UoA through the adoption of a 'thematic' approach to research, with the two principal themes of 'Healthy Aging' and the 'Health of Young People' being established. In the light of this, the recruitment policy has focused on recruiting members of staff to directly contribute towards these research themes. As previously mentioned, this has resulted in the recent recruitment of three members of staff who have already begun contributing through undertaking interesting and valuable research, which has resulted in several research outputs and applications for a number of external funding opportunities.

Within the UoA members of staff are managed by the Subject Leader (Dr Leo Stevenson), who is in turn managed by the Head of School. To ensure that staff are working towards individual and departmental targets and to highlight any areas for growth and improvement

**Unit-level environment template (REF5b)**

every individual must participate in an annual performance review. A departmental mentoring programme also exists, whereby all new members of staff are linked with a mentor (who is a more senior or long-standing member of staff) to ensure their smooth transition into the institute. Staff successes are also celebrated within the department by promoting these on the University webpage and the School bulletin and newsletter.

With regards to scholarly activity, LHU encourages and financially supports all academic staff to attend one conference per year where they can disseminate their research findings. Within the UoA several staff members have taken up this opportunity and attended and presented at a range of national and international conferences, including those organised by the Nutrition Society, Diabetes UK and the Federation of European Nutrition Societies.

Early Career Researchers are also encouraged to become involved in the supervision of PGR students. At the most basic level, this is in the form of an advisor and, with the guidance and mentorship of more senior academics, they can eventually progress to the level of Director of Studies. Two Early Career Researchers in the department (Dr Richard Webb and Dr Grace Farhat) have both applied to act as research supervisors. More senior academics are also encouraged to engage in the supervision of research students; however, it is suggested that they aspire to do this in a Director of Studies role. Dr Farzad Amirabdollahian has achieved this status and acted as the primary supervisor for a number of years, recently guiding three PGR students through to the successful completion of their PhDs.

In addition to this, several professional development workshops specific to the UoA have been delivered, with a view to improving the skillsets of researchers at LHU. These workshops have included inviting Professor Castori Senn (Oxford University) in 2018 to deliver a series of writing days specifically targeted around the field of 'Healthy Aging'. More recently, throughout 2019/2020 a variety of professional workshops centred around often neglected, yet vitally important skills were delivered. For example, the use of social media, scientific writing, and research grant writing. These complement wider research-orientated courses provided by the institute, for example a series of writing retreats which occurred in 2020, facilitated by Professor Tina Cook. These activities demonstrate our commitment to expanding our current portfolio of workshops and training, as described previously. More broadly, the University also holds regular 'Communities of Practice' sessions, whereby staff hold seminars on a range of topics, frequently relating to good research practice and conduct. This scheme has won several awards and a research project has recently been undertaken highlighting its effectiveness. All staff are strongly encouraged to attend and share examples of good practice and create a forum for discussion to improve upon these.



**Unit-level environment template (REF5b)*****Postgraduate Research Student Training and Supervision***

To ensure that PGR students are adequately trained and supervised the University has implemented several measures. For example, all PGR students are expected to attend annual monitoring meetings, where their performance is reviewed. Their progress is also gauged against the Vitae Researcher Development Framework, which is a series of criteria that demonstrates the knowledge, behaviour, and attributes of a successful researcher. Indeed, every PGR student mentioned in this statement has successfully completed this process. Furthermore, all PGR students are invited to skills development workshops, with topics ranging from 'research ethics' to 'how to write a thesis' etc. Just like staff members, PGR students at LHU are also encouraged to present their findings at national and international conferences; an opportunity taken up by every PGR student mentioned in this UoA.

For instance, the PGR students belonging to the UoA (Dr Kate Mooney, Dr Ben Kirk, and Dr Luke O'Brien) have all recently successfully completed their PhDs. These individuals were all Home / EU students, and they were all funded via the Vice-Chancellors Scholarship scheme. During their time at LHU each had access to the high-quality facilities available at the University, as well as the opportunity to teach across the Nutrition and Human Science undergraduate programmes in order to develop their lecturing skills.

***Equality and Diversity***

In addition to conforming with the Equality Act 2010 and building upon the Ref 2014 Equality Impact Assessment, the University has created its own Equality and Diversity policy. We adhere to these policies and all new and existing staff are expected to undergo annual Equality and Diversity training to ensure their knowledge is maintained. Statistics are also regularly reviewed to ensure that the University is operating in-line with these policies. Furthermore, although the University currently does not hold an Athena Swan Charter Mark, it is working towards this and has established a Self-Assessment Team designed to prepare the University for its submission.

More specifically, the UoA is proud to have historically had a heterogenous mixture of staff members, consisting of varying proportions of males and females from a variety of BAME ethnic groups. It is important to recognise that due to the small size of the department there is an inherent sensitivity in our Unit's statistics. That said, currently the UoA consists of three males and four female members of staff, with two being Middle Eastern, four from the UK and one who is Nigerian.

**3. Income, infrastructure and facilities**

Since REF 2014, LHU has undergone extensive development as a result of significant investment. Perhaps the most prominent example of this has been the creation of a Health Sciences building to house much of the School of Health Sciences, in particular the departments of Nutrition, Sports and Physical Activity. This new building has provided a hub for research collaboration and has facilitated a range of research projects to be performed relating to the Unit of Assessment, which would otherwise have been impossible given the previous infrastructure. An example of this is a randomised control trial investigating exercise and dietary protein as a countermeasure to skeletal muscle weakness (Liverpool Hope University Sarcopenia Aging Trial (LHU-SAT)). This study was led by Dr Amirabdollahian and performed by two PhD students funded by the Vice-Chancellor's studentship scheme (Dr Kate Mooney and Dr Ben Kirk). The study required elderly members of the public to visit the University several times, during which a number of measurements were taken, and they were asked to engage with the researchers and the intervention. Although the analysis of the data is ongoing, the principal findings highlighted that consuming a protein beverage along with physical activity and performing physical activity alone were driving forces for the prevention of sarcopenia; however, consuming a protein beverage in isolation was not. That said, it became apparent during the study that consuming the beverage was difficult for some participants. These findings have since been published in peer-reviewed journals, as well as being disseminated to local community centres across North West England. Furthermore, based upon the results from this study a symposium on "healthy diet and physical activity for older adults" was hosted at Liverpool Hope University in May 2019 and was open to members of the public. Furthermore, a 'Lectureathon' (8 hours of continuous and integrated expert talks) symposium regarding healthy aging was also conducted in collaboration with Age Concern in March 2017, raising £300 for the charity. These events increased awareness regarding the importance of diet and physical activity in promoting healthy ageing and this was evidenced by surveys and testimonials.

Within the new Health Sciences building, there are several laboratories supporting to the UoA. These include Nutrition Science laboratories, a specialist Food Science laboratory, and General Science laboratories.

The Nutrition Science laboratories contain a variety of equipment specifically relating to the field. Examples of these include instruments to measure body composition (i.e. BodPod and

**Unit-level environment template (REF5b)**

Tanita bioimpedance scales), devices to determine resting energy expenditure (i.e. QUARK and ECAL) and instruments to investigate an individual's vascular health (i.e. sphygmomanometer and Sphygmocor pulse wave velocity). This laboratory also contains devices for the measurement of anthropometric parameters, such as scales and stadiometers etc. Another recent study performed at LHU investigating the health of young people (i.e. Collaborative Investigation into the Nutritional Status of Young Adults (CINSYA)) directly relied on the use of these instruments. This study focused specifically on University students; a population known to have changes in dietary intake when starting their studies. The study, along with colleagues in Sports and Exercise Science investigated this in terms of their overall cardiometabolic health.

Similarly, the Food Science laboratories in the new Health Sciences building at LHU are purpose built to industrial standards and furnished with high quality materials and professional kitchen equipment. To the side of the kitchen is a vibrant seating area where seminars, lectures and workshops regarding food take place. Furthermore, the Food Science laboratory is also linked to an industrial standard sensory analysis suite, which has been built to ISO8589 standards. Within this suite each booth contains a touchscreen computer running Compusense software. This is a specialist piece of software which assists with the running of sensory tests and the analysis of the resulting data. An example of how these facilities have been used to contribute specifically to the research environment is via a study performed by Dr Grace Farhat, which investigated the effects of stevia consumption upon postprandial glucose response, satiety and energy intake; all crucial elements related to healthy aging. The study revealed that stevia was not associated with an increase in hunger and energy intake, a finding in line with previous clinical trials. The development of a high standard, purpose-built sensory suite has significantly enhanced our research capabilities and opportunities to engage with industrial stakeholders. This is a key element of the future strategy for the UoA, diversifying income and enhancing impact.

When performing the research projects mentioned in this UoA, for example, the LHU-SAT trial, where human blood samples needed to be analysed for several biomarkers, a variety of pieces of equipment were required. These included a Randox Evidence Investigator biochip immunoanalyser, Randox Misano semi-automated clinical chemistry analyser, BioRad Chemidoc imager, thermocycler, a variety of electrophoresis plates and spectrophotometers. These are housed in a number of general science laboratories utilised by the unit, which are specifically designed for research purposes. These stem from a central 'Research Laboratory' which also offers a variety of microscopes, a high-performance liquid

**Unit-level environment template (REF5b)**

chromatography (HPLC) workstation and a gas chromatography-mass spectroscopy (GCMS) workstation.

As well as hardware laboratory equipment, the university has also invested in a range of software programmes for research purposes. Compusense sensory analysis software has already been previously mentioned; other software programmes procured by the University include SPSS statistics (for the analysis of numerical data), MyFood24 (for remote dietary assessment during research studies), and Microdiet (also for dietary analysis). Similarly, to the hardware instruments previously described, these software products have been used across several research projects and have been essential to their success.

With regards to income generation, the research team for this UoA at LHU is very small and is largely composed of early career researchers. Although all members have been actively applying for external grant funding these applications have yet to be successful. It is important to note that a number of new staff members have only been recently employed and the grant applications have only been recently submitted over the last three years. In the light of this recent surge towards applying for external funding, the team are confident that in time and with continued focus and effort higher levels of success will be enjoyed. Furthermore, we would also like to emphasise our commitment to ensuring that this happens, and we are actively developing our strategy to increase the likelihood of this through external mentoring, developing our grant writing skills and collaborations with other institutions. We are also increasing our use of students to assist with the generation of preliminary data to enhance applications and by continuing our research momentum by maintaining and building upon our recent body of research students.

This UoA has enjoyed several 'grants in kind' to assist with the production of research. These include for the donation of an ECAL indirect calorimeter from Metabolic Health Solutions Ltd. as a grant in kind to enable a comparison study to take place with the commonly used QUARK RMR device (an instrument already housed at the University). Furthermore, Dr Claire MacDonald-Clarke, a key member of staff leading the CINSYA study which aims to investigate the health of young people, has also been working with a nationwide not-for-profit scheme called 'Let's get cooking', devised by the British Dietetic Association (BDA) and was facilitated by a £300 grant by the BDA. The aim of this scheme at LHU was to draw from the findings of the CINSYA study to promote student health and to increase the ability and confidence of students to cook, shop frugally and prepare food in a sustainable manner. This scheme was also developed in collaboration with the LHU Sustainability and Wellbeing team.

**Unit-level environment template (REF5b)**

Moving forward, it is the aim of the UoA to increase funding and infrastructure using a variety of methods. These include working with stakeholders in the community to gather further funding for impactful aging research; for example, Everton in the Community and Liverpool dementia action alliance (LDAA). Both organisations are actively accepting proposals for research projects and members of the team are currently engaging in discussions regarding prospective future research projects regarding healthy aging.

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

The University has actively encouraged national and international collaborative endeavours in order to not only enable our research strategy, but to also enable the UoA to perform the research it wishes to do. Some of these have resulted from inviting individuals and organisations to the University for research-related activities. For example, every year the University holds a week-long celebration for British Science Week. Since REF 2014 staff submitted to the UoA have invited several guest speakers to increase the profile of the research environment. For example, last year Dr Margaret Ashwell, a world-renowned expert in the field of Nutrition, was invited to deliver a talk to staff and students outlining her research achievements. Furthermore, during this week the Unit also showcases the research ongoing in the department with interactive workshops for members of the public to engage with, for example, some undergraduate and postgraduate research students presented their findings from their assessments and research respectively. Similarly, in June 2018 the University also invited members of the public to the 'Big Hope 2' conference. This was a University-wide event which aimed to tackle the four themes of freedom, conflict, equality and change with a range of high-profile speakers and a multitude of activities for delegates. Our Unit actively engaged with this event by contributing towards the theme of health's various activities and using the event as an opportunity to promote research undertaken by PGR students.

In addition to University-wide events, a series of subject-specific research seminars have been created, specific to the UoA. These have included varied internal and external speakers with research topics ranging from the use of insulin pump therapy in patients with Type 1 diabetes, through to the fortification of zinc in rural Pakistan. These have been open to staff, students, and members of the public and have contributed towards the creation of a vibrant research culture for all involved with LHU. Investment of funds has facilitated an improved programme of talks composed of experts in the field of Nutrition who aren't necessarily from local institutes. For example, Dr Christian Reynolds from the University of

**Unit-level environment template (REF5b)**

Sheffield who is a leader in the field of food sustainability. Although impacted in 2020 by the COVID-19 pandemic, these seminars are being maintained online as a significant component of our plans to enhance our research environment, exposing early career researchers and research students to dynamic speakers, broadening their knowledge of their subject areas and techniques and stimulating discussion and collaboration.

In addition to this, staff submitting to the UoA have delivered a range of sessions aimed at disseminating research into the local and wider community. An example of this was a symposium aimed specifically at the elderly, based upon findings from the LHU-SAT study previously mentioned. This workshop was a resounding success, with 40 people attending and many of the participants feeding back that the session had a positive impact upon their lives. Open sessions such as these have directly contributed to the research environment by allowing the general public into the institute to directly engage with academics submitting to the UoA and allowing research findings to permeate directly to the individuals who are likely to benefit most from the outcomes.

Staff within the Unit have been active in developing collaborative activities with other institutions and external partners with a view to improving the research environment within the UoA by enabling research to take place which would not have been otherwise possible. These collaborations are numerous and key strategic relationships exist in the local area. An example being with Liverpool John Moores University (LJMU), where members of the UoA have a number of previous and ongoing research studies. For example, Dr Leo Stevenson has been involved with a study to assess the quality of takeaway foods across the city of Liverpool, Dr Richard Webb is currently involved in a study to determine the cardiometabolic risks of individuals using anabolic steroids, a prevalent activity within young adults and Dr Amirabdollahian has been involved in research to determine the cardiometabolic risk in phenotypes of obesity related to diet, nutritional status, lifestyle and physical activity, which is crucial for healthy aging. Other local collaborations are with colleagues from Edge Hill University, where Dr Grace Farhat has performed a study to determine the effects of dark chocolate upon salivary cortisol.

Outside of the local area the UoA has engaged with various other collaborators from UK institutes; for example, the University of Nottingham, where Dr Farhat has been working on a number of external grant applications with colleagues to investigate brown fat. Dr Stevenson has also collaborated with Aberystwyth University to further his research into take-away foods by analysing the urine of habitual consumers of these products to determine if metabolic 'signatures' associated with take-away foods can be detected.

**Unit-level environment template (REF5b)**

Links with these partners have contributed to the research environment by allowing the organic growth of ideas into projects and collaboration with experts from a range of fields and access to facilities and equipment which would otherwise be out of reach. For example, a recent project with Northumbria University and LJMU to develop a superior method for the separation of lipoprotein particles from human blood required the use of an ultracentrifuge and metabolomics suite, both of which are unavailable at LHU. However, the partnership with these external collaborators has enabled this to happen and the results are now being prepared for publication. Another example is the use of a clinical autoanalyser for the analysis of human blood samples collected during the PhD of Dr Luke O'Brien. The close working relationship LHU has with LJMU facilitated this and allowed Dr O'Brien to obtain results for various blood markers which would have not otherwise have been possible using the infrastructure of LHU alone.

These links are continually growing and benefitting the research environment, with the most recent additions being the formation of strong links with the School of Medical Sciences at Universite Catholique de Lille in Lille, France and the Ouachita Baptist University in Arkansas, United States, where Memoranda of Agreements have been formed. The agreement with the Ouachita Baptist University is focused on staff and student mobility and gives students exposure to nutrition research-based projects and training in study design, recruitment and ethical procedures. The visiting research students have also had the opportunity to learn practical research skills during their time at LHU, such as new laboratory techniques and how to operate several instruments such as centrifuges, plate readers and immuno-analysers to carry out multiplex arrays and ELISA assays etc. The benefits of this for our Unit are that it allows us to collect preliminary data, which can be used to strengthen subsequent grant applications and present at conferences, thus improving our research profile. Furthermore, it also allows supervising staff members an opportunity to improve their leadership and supervisory abilities.

In addition to forging collaborative links with institutes and organisations, members of staff submitting to the UoA have also contributed through other means, such as via national and international committees. For example, Dr Leo Stevenson is currently an external reviewer for the National Institute for Health Research (NIHR) School for Public Health Research (SPHR) and is responsible for reviewing and advising on project funding being awarded to those institutions who are members of the NIHR SPHR. This has the potential for Dr Stevenson to gain exposure to the types of proposals being submitted by groups with much more capacity and experience than the UoA. Dr Stevenson will then be better placed to

**Unit-level environment template (REF5b)**

advise members of the UoA when devising proposals, thus further optimising the likelihood of success. Furthermore, Dr Grace Farhat has also contributed directly to a recent agreement with the Faculty of Medicine in the Universite Catholique de Lille to initiate research focused on obesity; however, due to the COVID pandemic this has not yet been possible. Similarly, Dr Farhat also participated in the Erasmus scheme, an outcome of which was to be the initiation of further research projects, but again this has been delayed due to COVID. Endeavours such as these have in turn improved the research environment at LHU through the development of relationships which have stimulated the formation of new research projects, with more to be established in the future.

To conclude, the UoA at LHU consists of a very small, but highly ambitious group of people, who are working tirelessly to grow the research environment into a sustainable entity that will contribute worthwhile and impactful research with a view to improving healthy aging and the health of young people. This is the ultimate goal of the staff members and whilst this is our first REF submission and we are starting from a low baseline we are enthusiastic to develop upon this in subsequent exercises. We are aiming to do this by influencing and leading the institutional and departmental strategies outlined in this document to build a vibrant and productive research environment for those working within it, for our wider disciplines and ultimately for society as whole.