Institution: University of Exeter

Unit of Assessment: 2

1.0 Unit Context and structure

Our ambitious, external-facing and visionary interdisciplinary research programmes are focused in areas of global, national and regional importance. These developments have benefited from strategic investment from the University of Exeter, UK Research Councils, Charitable funding and major Philanthropic donations (Gillings, Gates, Sowerby). This trajectory is set to continue as we develop new programmes and recruit world-class researchers with a focus on collaborative, interdisciplinary research. We make substantial, sustained contributions to issues of vital importance to society including, but not confined to, primary care, public and environmental health, dementia and child health.

This dynamic unit has seen outstanding development in this last REF-cycle. Key achievements include:

- Tripling in research capacity from 24fte to 60fte in UoA2 in addition to allocating 10 staff to our newly established submission (2021) in U0A3, and 7 to UOA7&4.
- 226 current registered PhD students (compared with 50 completions REF2014)
- Re-funding (2020) of NIHR Applied Research Collaboration (one of just three achieving a third unconditionally-funded cycle)
- Successful application to become a NIHR School of Primary Care Research (start April 2021)
- Establishment of comprehensive inter-disciplinary neuroscience research programme focussing on Dementia
- National honours recognition for several staff (CBE,OBE,MBE)

Since the 2010 establishment of the University of Exeter Medical School (UEMS), we have strategically managed growth and development to include the establishment of the College of Medicine and Health (CMH, 2018, incorporating UEMS); founded and incorporated the Exeter Academy of Nursing (2019); and established the Exeter Clinical Trials Unit (2015). Growth in our undergraduate BMBS programme (doubling capacity to 218 p.a. in this cycle) is matched by expansion of our BSc Medical Imaging programme (top 5 in all major UK league-tables), and development of our Medical Imaging Degree Apprenticeship (first cohort 2020). Our Academy of Nursing admitted its first cohort in 2019.

Within CMH, our research (Figure 1) is managed through two Institutes, Biomedical and Clinical Science (IBCS; Director, *Morgan (UoA1)*) and Health Research (IHR; Director, *Hulme*). UoA2, presented here, primarily draws staff from IHR. But each institute is strongly inter-disciplinary, embracing a range of clinical and health disciplines, and benefiting from support from a team of outstanding research methodologists. The two Institutes' staff (IHR 196.4fte, IBCS 157.5fte) are based across four sites in Devon and Cornwall. Our core presence in Exeter places us in the civic centre of the Southwest. Our Cornwall sites are uniquely placed to explore the health challenges of both rural and costal deprivation, and the important relationships between ocean, climate, environment and health. Our staff and students are located in close proximity to and collaborate with NHS Trusts, primary care and community services, social care, local authority and patient and public collaborators across the South West region as well as nationally and internationally.

UoA2 research is focused in four themes:

1. Diabetes, Cardiovascular Risk & Ageing
2. Neuroscience, Neurodegeneration & Mental-health
3. Environment and Human Health
4. Health Services Research

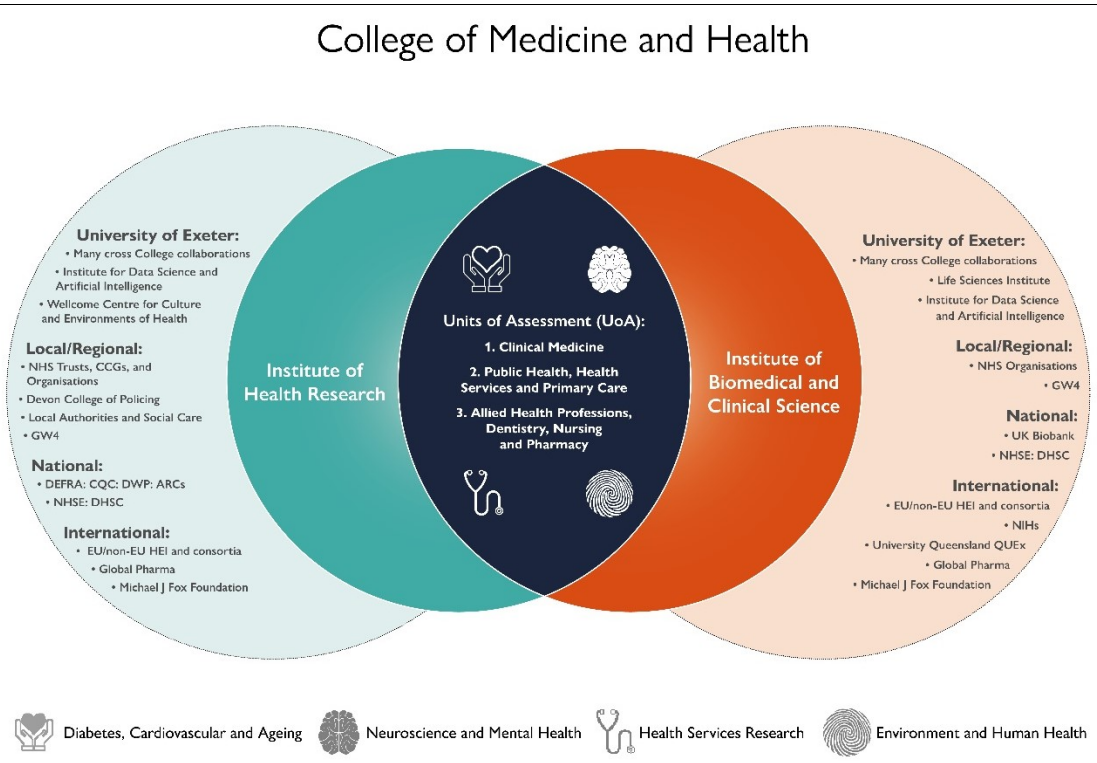

Figure 1: Structure of the University of Exeter CMH; links illustrative only

1.1 Research and Impact Strategy

Our mission is **to improve the health of the South West and beyond through the development of high-quality graduates and world-leading research that has international impact**. Our strategy builds on the aims articulated in our REF2014 submission. These goals are held in constant focus and have underpinned our substantial expansion, allowing us to sustain world-leading research driven by important health questions and supported by our collaborative, interdisciplinary methodological work and applied health research that reflects the needs of both health-service providers and patients.

1.2 Achievements of strategic objectives since 2014

At REF 2014, UEMS had already emerged as a leading medical research institution with a steeply rising research income and a burgeoning international reputation. At that time, our return for UoA2 was small (24.58fte). Guided by internal advice and the recommendations of international external-advisers, a primary goal has been to build on this strong platform by expanding our research base. Significant strategic investment has occurred in research capacity and infrastructure, specifically to facilitate interdisciplinary interactions. We have maintained a laser-like focus on areas of existing and potential strength and on the recruitment and career development of our people, thereby enabling staff and their research to develop and flourish.

Against this background, we have maintained our focus on the strategic objectives articulated in our Research Strategy for the current REF period:

(i) **Achieving critical mass and world leading quality** by new academic appointments and the nurture of early-career researchers and “rising stars” identified within our teams;

(ii) **To work with people and communities to benefit health**;

(iii) **To provide a supportive environment where researchers can reach their full potential**.

Given that CMH research spans basic through clinical science to clinical trials and the implementation of change, our aim is to ensure that the two internal research institutes, IHR and IBCS, work together on their core activities in an interdisciplinary manner. We have made excellent progress against each of these strategic objectives.

1.2.1 Achieving critical mass and world leading quality

We have made remarkable progress since REF2014. Our staff return in UoA2 has increased from 24.56fte to 59.92fte *in addition to* increasing CMH staff contribution to other UoAs(10fte to new UoA3 submission, and 7fte to UoAs4&7).

In 2008 and 2014, we emphasised the need to invest further to develop our core methodological skills in applied health research. Strategic appointments have therefore been made to enhance our expertise and interdisciplinarity. We now have critical mass in the key methodological areas required in a first class applied health research unit with strong methodological groups in Medical Statistics(*Henley, Taylor, Abel, Ukuommune, Ball*), Health Economics(*Green, Anderson, Medina-Lara, Spencer, Hulme, Smith*) to add to our previously existing expertise, which we have also expanded, in Sociology and Qualitative methods (*Britten*), Systematic reviews and Meta-analysis (*Stein, Hyde, Melendez-Torres, Thompson-Coon*), Epidemiology(*Logan, Melendez-Torres*) and Clinical Trials(*Taylor, Creanor, Lamb*). We have expertise in operational research, data science and AI(*Pitt, Abel*) and as one of the 13 partner institutes (having joined the Turing Network in 2018) three of the 26 UoE Turing Institute Fellows sit in CMH(*Fleming(UoA7),Llewelyn, Monks*). Our Exeter Test Group(*Hyde*) is an established centre of excellence in test evaluation. The PPI team offers high level expertise, facilitating the contribution of the Peninsula Public Involvement Group (PenPIG). This level of input has supported the submission of many high-quality grant applications with robust involvement strategies.

A key focus of methodological research since 2014 has been development of novel and innovative solutions in patient experience of care (*Campbell, Abel*), diagnostics (*Hyde, Hamilton*), surrogate outcomes (*Valderas*), and qualitative research synthesis & meta-ethnography (*Britten, Frost*). For example, *Britten* was a member of the advisory group of the eMERGe project which produced the first guidelines for the conduct of meta-ethnography (France 2019), several published meta-ethnographies (Frost 2014), and one of the first updated meta-ethnographies to be conducted (Germeni 2018). Our outstanding PPI team is also committed to developing the evidence base for involvement by helping to theorise the processes involved (Gibson 2017, Liabo 2018), and studying involvement empirically (Frost 2018, Cockcroft 2019).

We are engaged in a programme of sustained investment in neuroscience, neurodegeneration and mental-health research. This new and exciting body of national and internationally leading research has developed substantially since REF2014 and is a core element of our research platform going forward. The strategic appointments of *Clare* (UoA4,2015), *Ballard* (2016), *Testad* (UoA3,2017) and *Politis* (UoA1) (2019) have strengthened our neuroscience research capacity, with research spanning the testing of new interventions to prevent or improve outcomes in dementia, improve clinical care, and inform service provision in care homes and the community.

We have benefitted from receipt of the University's largest ever philanthropic donation; £10M received from the Gillings' Foundation to appoint internationally renowned research professors within IHR (*Lamb*) and IBCS (*Ryu* & *Thirlwell* UoA1). *Lamb* assumed the senior research-leadership role of Associate Dean for Research in CMH in September 2020. Such appointments have enhanced our profile and expertise in clinically applied research, and have created champions to promote our ambition to ensure that women achieve their full potential in science and medicine.

1.2.2 Work with people and communities to benefit health

Our strengths lie in interdisciplinary methodological research and in applied health research that reflects the health and wellbeing needs of the public, service users, and health-service commissioners and providers. Fundamental to this is our deep and sustained partnership with local and regional NHS bodies, evident in numerous joint ventures as well as excellent established relationships with industry, charities, public bodies, local authorities, police service and businesses all of which enhance the quality and reach of our research (see also section 4).

We have close links with clinical colleagues employed by the NHS who have honorary academic contracts with the UoE (Category C staff e.g. Dalal, Shankar, Sheridan). For example, Professor Dalal, a senior academic GP who acquired a higher research degree through UoE (2007) has led major NIHR programmes of research in Cornwall and directly informed the configuration of cardiac rehabilitation service delivery in the UK. Such arrangements ground our research firmly in NHS organisation, service delivery and policy. Our activities across the clinical arena have been facilitated by the formation of a Joint Research Office (**1.7 Institutional Level Environment Statement (ILES)**), providing an interface between the NHS and academia and overseeing working arrangements for NHS staff, addressing relevant funding issues including hosting of awards, allocation of RCF, and facilitation of joint strategic working. Key amongst these is our world leading record of PPI in research (section 4.2).

'Research engagement by Design' and Partnership Building

A key strategic imperative adopted within UoA2 is 'engagement by design', building partnerships between members of the public, patients, NHS clinicians and managers, policy makers and academics to identify key research and implementation topics. Our research thus targets the needs of key stakeholders, matching our ambition that high-quality research is translated into improved practice. Examples include:

- Changes to national service location planning for acute stroke units in England and Northern Ireland, optimising effective and efficient thrombolysis and thrombectomy after stroke.
- Changes to psychiatric bed capacity and care pathway planning to enable regional mental-health services to meet patient needs (providing the evidence base to support establishment of a new £8M psychiatric ward development in Devon).
- Informing national public health policy and supporting local authority practice to prevent suicides in public places.
- Establishment and ongoing use of the National General Practice Patient Survey (GPPS), using evidence of patient experience of primary care services nationally to inform national primary care policies, planning of local services (e.g. by Clinical Commissioning Groups), Care Quality Commission inspections of practices, and informing patient choices (NHS website).
- National leadership and development/implementation of NICE guidance in early cancer diagnosis in primary care directly building on our related, focussed research activity. *Hamilton* represents primary/community care on UK Innovation Expert Implementation Group (£200M to improve cancer diagnostics).
- Research undertaken to evaluate the effectiveness and cost-effectiveness of testing for the most prevalent form of hereditary cancer (Lynch syndrome) directly informed national policy(NICE 2017) that all colorectal cancer patients should be tested for Lynch syndrome.
- Our research has directly informed national and international guidance on the provision and delivery cardiac rehabilitation. The research programme demonstrated the clinical and cost-effectiveness of home-based cardiac rehabilitation for patients in heart failure,

informed NICE(2018) and BHF(2020) guidelines for management of heart failure to focus on the provision of home-based programme of cardiac rehabilitation, and led to discussions(2020) with NHSE/I regarding establishing a national leadership resource in cardiac rehab hosted within this UoA.

- Building on the work of our researchers in conducting trials leading to the approval of the first treatment specifically for Parkinson's disease psychosis in the US, we have conducted trials focussing on Dementia Related Psychosis, with an application for approval for this treatment indication under consideration by the FDA (late-2020).

- Developing and evaluating the sector leading WHELD nursing home training programme across four major randomised controlled trials (RCTs), with roll-out to 1200 care homes in the UK as part of UKRI COVID support.

- Research from our European Centre for Environment and Human Health (ECEHH) has identified the value of the natural environment as a setting for physical activity as around £2.2B of annual health benefits, as well as demonstrating the link between green-space and improved health outcomes. Informed by this research, national and local government policies have recommended that the health benefits of natural environments be recognised in spatial planning, environmental management, and asset-based health promotion/protection. This has resulted in UK Government investment of ~£10M in natural environment health promotion programmes; explicit integration of health into green-infrastructure standards for England; inclusion of environmental interventions in £4.5M funded social-prescribing plan; and EU investment of £3.5M in urban Public Open Space in Cornwall.

- This basic philosophy extends into our work with communities and in the environment, where we engage with key stakeholders as partners, rather than in a purely consultative style. This is exemplified by *Wyatt's* work with schools (NIHR and All Saints Trust), where interventions aimed to reduce obesity are developed in conjunction with children, teachers and parents before evaluation in large trials.

1.2.3 Providing a supportive environment where researchers can achieve their full potential

1.2.3.1 Formation and further development of centres of excellence for research

In addition to our newly established Academy of Nursing, we have established the Exeter Clinical Trials Unit (Director, *Creanor)*, which has gained UK Clinical Research Collaboration (UKCRC) provisional accreditation to build our capacity in clinical trials. Our capacity to deliver large scale clinical trials has been further expanded by transfer of the NIHR Research Design Service South West (RDS-SW) to Exeter in 2018. The arrival of this service has increased the critical mass of methodological expertise locally and has cemented the establishment of effective links with the NHS across the south west region. The RDS-SW is supported by a five year grant from the NIHR (third successive award) and is hosted by Royal Devon and Exeter NHS foundation Trust (RD&E). The Director, *Taylor*, is based in CMH but the service strengthens our regional connectivity via hubs in Bournemouth, Bristol and Plymouth giving a total staff commitment of 15.8fte among 25 methodologists and support staff.

The vitality of our research is demonstrated in our success in hosting international, national and regional research centres. Notable successes include:

- The Peninsula Collaboration for Leadership in Applied Health Research and Care (PenARC, Director, *Logan*), one of the first 9 National centres for translational research funded by NIHR, was re-funded in 2013, and, in 2019, with our partners we obtained a further investment of £9M for the next 5 years as an Applied Research Collaboration (PenARC) (£20.5M in funding since 2014). PenARC has been designated by NIHR to lead nationally on Child Health Research and Operational Research across the ARCs with associated funding of £2M. The

bulk of the PenARC funding provides core methodological staff who support the development of grant applications. This includes a PPI team whose work is considered exemplary and world-leading.

- Peninsula Technology Assessment Group (PenTAG, Director, *Melendez-Torres*) is one of the small number of National Centres for Technology Assessment established with NIHR core funding in 2001, with successful renewal in 2011 and subsequent successful renewals of £3.5M in 2016 and £5.7M in 2020.

- The European Centre for Environment and Human Health (ECEHH) (Director, *Fleming*): an interdisciplinary research centre studying the relationships between the environment and human health and wellbeing. Since 2014, ECEHH attracted funding from NERC, BBSRC, MRC, ESRC, Innovate UK, Wellcome, Leverhulme, NIHR, DEFRA, GCRF, and EU. We have also secured a further £10M from ERDF and were designated a WHO Collaborating Centre in Natural Environments and Health.

- The development of our Neuroscience, Neurodegeneration & Mental-health group which includes an Alzheimer's Society Centre of Excellence (IDEAL programme) and ARUK Deep Dementia Phenotyping (DEMON) Network, membership of multiple national and international networks including Dementia Platform UK, the NIHR Mental-health Translational Research Collaboration) and the European Dementia with Lewy Body network (see also section 1.4.1).

- Evidence Synthesis, a particular strength, has been underpinned by infrastructure grants including the Exeter NIHR HS&DR Evidence Synthesis Centre (2017, £600k renewal of contract in 2020 £600k), Exeter NIHR Policy Research Programme Evidence Review Facility (2020, £2.5M).

- APEx (Exeter Collaboration for Academic Primary Care), an internally funded centre of excellence focussing on primary care research. APEx researchers are associated with substantial research income (£140m since 2014), and the Collaboration acts as a platform for primary care research and educational activity of direct relevance to NHS/NIHR and with a range of major national/international collaborations. In 2020 we were awarded NIHR National School of Primary Care membership (start April 2021, indicative funding £32M to NSPCR).

1.2.3.2 Creation of new research facilities

We have had multi-million pound investment in new research facilities. South Cloisters and College House, house researchers on the St Luke's Campus; MRI & PET imaging facility in collaboration with the RD&E NHS Foundation Trust and support from the Gillings' foundation; Wellcome Wolfson Medical Research Centre (WWMRC) in collaboration with the RD&E Hospital NHS Foundation Trust; VSimulator facility in 2020 (total cost £11.7M including a £4.5M EPSRC Equipment grant) as part of a new research facility on the Exeter Science Park; and the Wellcome Centre for Cultures and Environments of Health in 2017. Details of these facilities and other major investments are outlined in section 3.

1.2.3.3 Excellence in research

Our staff have continued to operate at the forefront of research globally. In UoA2 we have published >3,000 papers in world-renowned journals including Lancet, New England Journal of Medicine, JAMA and BMJ. We have featured publications in the Altmetric Top 100 annual list of research papers, 2017 Lancet commission on dementia (*Ballard*) (2019 *Llewellyn, White*) (https://www.altmetric.com/top100/home/about/). UoE entered the world top 20 for Biomedical and Health Sciences in the CWTS Leiden Ranking 2019, based on the percentage of publications ranked in the top 10%most cited.

Our excellence has been recognised by prestigious honours, include Royal College of General Practitioners (RCGP) research paper of the year award 2014 and cancer category winner 2015,

2016 (*Hamilton*), Weston Institute Brain Award 2018 (*Ballard*), BMJ Stroke and Cardiovascular Care Team of the Year Award 2020 (REACH, *Taylor*).

Agility remains a critical core attribute; this has been exemplified by our rapid response to the COVID-19 pandemic. Our portfolio of COVID-19 research studies includes: *Campbell* (with *Warris* UoA1) heads an arm of the international BRACE trial testing the efficacy of a BCG vaccine in COVID-19 patients, with support from the Gates&Sowerby Foundations; *Ballard* is leading the WHELD nursing home training programme across four major RCTs, with roll-out to 1200 care homes in the UK as part of UKRI COVID support, and *Pitt*, Chair, National Covid-19 Operational Research Network, using operational research approaches to inform COVID-related redesign of the Wessex dialysis service and end-of-life care resource management at University Hospitals Bristol and Weston.

1.3 Future strategic aims and objectives

The College's Research Strategy 2019-2024 highlights our continuing commitment to focus within our target themes coupled with strategic investment. Our aims now are to further strengthen our research culture, collaborations and partnerships, and our operational structures (**2.1 ILES**). Our principal strategic aims for the next 5 years are:

1.3.1 To develop critical mass and world leading quality

We are engaged in a programme of sustained investment in neuroscience, neurodegeneration and mental-health research; building on the exciting body of national and internationally leading research that has developed substantially since REF2014 and is a key element of our research platform going forward. Key recent strategic appointments (see 1.2.1) have strengthened and accelerated our neuroscience research capacity. We will continue our proactive scheme to identify and recruit "rising stars" supported by income from increasing undergraduate student numbers, increased philanthropic activity and strategic institutional investment.

Our sustained programme of growth is complemented by a College-wide global strategy to facilitate researcher interactions overseas, enabling the recruitment of excellent international students and staff as a means to enhance research skills. *Melendez-Torres* has recently been appointed Associate Dean Global in CMH. In addition, specialist support services and advice in support of these initiatives is provided via our Research Services teams and by the Innovation, Impact and Business team (**4.6 ILES**).

1.3.2 Working with people and communities to benefit health

Collaboration is a central theme within the strategy. Our strong track record of successful collaborative work with local service providers is evidenced by the success of our NIHR ARC and the leading role played by our researchers in the region. Our particular strengths are in interdisciplinary methodological work and applied health research - research that reflects the needs of both health-service providers and patients. Fundamental to this focus is our deep and long-lasting partnerships with local and regional NHS bodies, evident in numerous joint ventures, as well as excellent established relationships with charities, public bodies, local authorities and businesses (for example, Royal Devon & Exeter (RD&E) NHS Foundation Trust, South West Academic Health Sciences Network, Cancer Research UK, Alzheimer's UK). Our strong record of PPI in research is based on a collaborative, partnership model based on co-creation, rather than on 'consultation'. Patients, clinicians, educators, parents, carers, businesses and 'other publics' contribute to all stages of the research process. Fundamental to engagement is the role of external exposure, which can often facilitate impact opportunities. CMH has a dedicated Senior Press and Media Manager, who runs a team that oversees our social media outlets (Facebook, Twitter, Instagram and LinkedIn) and who optimise opportunities for research-related media coverage. In 2019 CMH generated 320 press releases/web stories, totalling more than 20,000 items of media coverage. In 2020 the BRACE trial alone (*Campbell*) has generated >1,000 media hits.

1.3.3 Provide a supportive environment where researchers can reach their full potential

We continuously develop and improve our mentorship, supervision and personalised development programmes for all staff, by active engagement in relevant human resource strategies. Going forward, this will involve the implementation of changes to our current promotion procedures so that all staff are reviewed for promotion at least biannually. We will also reinvigorate the provision of active mentoring of all staff seeking external 3-5 year competitive Fellowship support and continue to offer generous "in-kind" support (e.g. matched funding for equipment; PhD studentship) to promote their success.

The College has been actively developing a workload allocation model in accord with the principles articulated by the University (**3.4 ILES**) and is committed to the provision of dedicated time for those involved actively in the development of research impact. This activity is not solely REF-focussed but is driven by our commitment to conduct research having demonstrable benefit within our locality and beyond. One component of this support is the underwriting of a fully funded "impact fellow" to assist staff in achieving their goals.

We will promote the operation of existing (and, where appropriate, the formation of new) networks for Early-career Researchers and Parent and Carers' groups to enable peer support and to act as change agents within CMH. One part of this ambition is to maintain an actively "family-friendly" culture in line with the receipt of our Athena Swan Silver award to ensure that all staff have an appropriate work-life balance.

We will also contribute actively to the promotion of a culture in which Responsible Metrics are championed in considering all appointments, cases for promotion and personal development. To this end, we have a nominated CMH "responsible metrics champion" who engages with broader University initiatives and serves as a conduit to promote a change in philosophy and practice among CMH staff.

1.4 Research Groups

Our research groups cross-cut Health Services Research (HSR), Public Health and Primary Care; aligning with the CMH research themes noted earlier.

HSR comprises a wide portfolio of research that includes basic methodological work (particularly in medical statistics, economic modelling, ethnographic research and patient/public involvement), as well as applied research including: mental-health (including dementia), diagnostics and stratified medicine, person centred care and high quality evidence provision.

Public Health is a major part of the work of the ECEHH, PenTAG and PenARC. One of our strengths is our work on screening for and surveillance of disease. A further distinctive is our emphasis on environmental issues and health. We have a major interest in working with schools and disadvantaged communities to improve health and reduce health inequalities together with expertise in the design and evaluation of health behaviour interventions, innovative approaches to the promotion of healthy lifestyles, understanding the relationship between environment and health (aided by links to the ECEHH), and reducing morbidity and disability in later life.

Primary Care works closely with HSR and Public Health round: (i) primary care-focused patient centred health services research (primary care service delivery and organisation, patient experience and outcomes of care) (ii) primary care diagnostics research, focusing on early cancer diagnosis (iii) ageing, frailty, and multi-morbidity. The group has produced >1,200 outputs in major journals across each area during the assessment period. Examples include major clinical trials and studies in: telephone triage and novel modes of consultation and access to NHS online services (ESTEEM, Telefirst, OBoE); depression (COBALT, MIR, CBT-O), cancer (Cantest, ERICA), cardiovascular disease (INTERPRESS, REACH-HF), and ageing/ multi-morbidity (BOOST, numerous trials in musculoskeletal disease and rehab); and research into patient experience (IMPROVE) and safety of care (PREOS) of care and primary care workforce/workload

(REGROUP). The group includes five core researchers (*Campbell (lead), Hamilton, Valderas, Abel, Lamb*), and *Dickens* (Primary Care Psychiatry) and *Clare* (Dementia research). Each leads their own research-group, with extensive joint-working, pooling of effort, and coordinated career-support for early-career staff. Following concerted strategic growth and development, we have recently attained membership of the NIHR National School for Primary Care Research (notified May 2020).

1.4.1 Neuroscience, neurodegeneration and mental-health

This exciting body of national and internationally leading research has developed into a key research focus since REF2014 The appointments of *Clare* (UoA4), *Ballard* (UoA2), *Fossey* (UoA3), *Testad* (UoA3), *Ryu* (UoA1) and *Politis* (UoA1) build on existing strengths in data-science (*Llewellyn* UoA2), neuroscience, genomics and epigenetics (*Mill*, *Lunnon* UoA1), spanning from genomics, pre-clinical science and drug/treatment development through to the maintenance of cognitive health and clinical trials. We are an Alzheimer's Society Centre of Excellence for dementia care research, a member of Dementia Platform UK, and partnerships include the NIHR Translational Collaborations for dementia and for mental-health, the Global Council on Brain Health, the World Dementia Council, the Australian NH&MRC Centre of Research Excellence in Cognitive Health, the Turing Institute and Early Detection of Neurodegeneration (EDoN), with extensive collaborations in the UK and internationally.

Our biological and epidemiological research focuses on the causes of dementia, reducing dementia risk, identifying novel treatment targets (>£3M, MRC and NIH programmes) and evaluating therapies in pre-clinical cell and novel animal models (£2M Gillings Foundation) with research spanning bench to bedside.

Our focus on maintaining cognitive health is delivered through our PROTECT programme, a large international cohort study and clinical trial programme with 50,000 participants and more than £4m in funding to provide computerized neuropsychology for clinical trials, recruit for our clinical trials programme, and validate diagnostic technologies; the programme has already recruited more than 20,000 people to clinical trials and developed and evaluated an evidence based cognitive training programme. An additional partnership with DECODE in Iceland provides genome wide analysis of DNA from PROTECT participants (worth >£1M in kind) and international academic and commercial partnerships to run cognitive health registries in the US, Norway and Canada.

Our phase 2 clinical trial programme, with partners at King's College London, Imperial College London and University Hospital Stavanger has more than £15M of funding from NIH, UKRI, IMI, ADDF, HTA, Alzheimer's Society, Charles Wolfson Trust, Moulton Foundation, Norwegian funders and commercial partners to conduct phase 2 trials of liraglutide, fasudil, phenserine, an alpha 7 nicotinic agent and vitamin D in people with early or mild Alzheimer's Disease (AD), emerging from our Wellcome Trust drug discovery programme (£1.8M); and trials of pimavanserin, ondansetron and mirtazapine for psychosis and other neuropsychiatric symptoms in AD and Parkinson's Disease (PD), which has underpinned an FDA application for the use of pimavanserin for the treatment of dementia related psychosis.

Our recently-opened neuroimaging facility (£5M Gillings' foundation) has been a key development that has enabled new successful avenues of research is described below (3.2), with funding (£750k) to participate in an IMI2 European Union consortium to assess serotonergic defects and brain networks underlying depression and anxiety in patients with Parkinson's disease and £6M of funding from the Michael J Fox foundation.

Our diagnostic research aims to enhance the timely detection of dementia, combining evidence-synthesis, data science and machine learning to develop new translational insights. Research includes identifying modifiable aspects of gene-by-environment interplay in later-life cognitive decline (~£3.02M, National Institute on Aging) and National Health and Medical Research Council funded, Identifying pathways to dementia: a large scale genetic study (Au$447,559).

Research in Ageing and Cognitive Health (REACH) has pioneered personalised cognitive rehabilitative interventions to support people with mild-to-moderate dementia in the community (£2M *Clare*) and to improve wellbeing and mental-health for people with dementia in care homes (£3.5M *Ballard, Fossey*), including 2 UKRI funded programmes (£2M) as part of the COVID rapid response initiative. We also lead a JPND programme (£750k) trialling self-management and health promotion interventions for people with dementia (*Testad, Clare*).

Our Mental-health Research Group (MHRG) addresses treatments for depression and psychosis, with major programmes focussing on Improving quality of life and health outcomes of patients with psychosis through a new structured intervention for expanding social networks (NIHR £2.7M), the prevention of suicide in non-clinical populations (NIHR £2.6M), and the development of a novel animal model of depression (Gillings Foundation *Ryu*), with a programme underway to identify a new class of antidepressants targeting HPA axis dysfunction.

1.4.2 Diabetes, Cardiovascular Risk & Ageing

Alongside the expansion of our dementia and neuroscience research, we have expanded our expertise and capacity in healthy ageing with the appointment of two senior academics in this area (*Lamb 2019, Hulme 2018*). *Lamb*, with a focus on rehabilitation and falls prevention, has led major research exploring a range of interventions for the prevention and management of falls, fracture and frailty. She will be expanding her research group as she deploys her Mireille Gillings Fellowship, increasing capacity in leadership. She is currently working with colleagues in Engineering, Maths, and Sport and Health Sciences on the health and wellbeing work stream on the EPSRC-funded VSimulator project to better understand human movement and its interaction with the built environment. This work will contribute to the development of future health technologies.

Hulme provides health economics expertise with a focus on older people and healthy ageing. Current research focus lies on management and measurement of frailty; this includes the NIHR-funded HERO trial of rehabilitation for older people living with frailty (£2M); NIHR funded research exploring personalised care planning to improve quality of life for older people (£2.75M); and NIHR funding for the development of the electronic frailty index+ (eFI+) £550k

Our rehabilitation research draws together a broad, methodologically-robust programme on the development and evaluation of complex interventions for older people and those with long-term conditions funded by NIHR and the Stroke Association in collaboration with partners from other UK and international institutions. Our portfolio of research includes exploring behaviour change in a range of long-term conditions including stroke (Stroke Association-funded ReTrain study), cardiovascular disease (NIHR-Ecoacher, NIHR REACH-HF) and urinary incontinence (NIHR-OPAL). *Clark's* research on cardiovascular risk-profiling and mitigation has informed national hypertension guidelines in North&South America and Europe, and is the basis of collaborative impactful research reported by Sussex (UoA12).

Our research in diabetes has been enhanced significantly by the creation of a Centre of Excellence in Diabetes with support from Research England in 2019 (£6M plus £2M match from UoE). The Centre is now staffed to its initial target capacity after a highly successful recruitment programme. This has achieved a broad interdisciplinary profile covering statistics, bioinformatics, artificial intelligence, cell biology, immunology, genetics and clinical medicine and includes research in both prevention (NIHR funded Community-based Prevention of Diabetes (ComPoD), *Smith*) and management of type-2 diabetes (NIHR funded Managing with Learning Disability and Diabetes, *Hulme*).

1.4.3 Environment and Human Health

Our European Centre for Environment and Human Health (ECEHH) is an interdisciplinary research centre studying the relationships between the environment and human health and wellbeing. Established in 2010 with £14.2M investment (European Regional Development Fund and the European Social Fund, plus £5.8M matched funding from UoE) it is now a large and

sustainable unit with a staff and student cohort of almost 100 leading/participating in >50 research awards, funded by 20 different funders, with an income value to the University of over £13M.

The Centre is a designated WHO Collaborating Centre in Natural Environments and Health with extensive international and national networks of partners, reaching across lower and higher income countries in North and South America, Asia, Africa, Australia, and Europe. Closer to home, staff have strong links with our local community, engaging with over 150 local businesses and not-for profit organisations, working with local public health teams across the South West (as well as the Greater London Authority) and our SW NHS Trusts. We also have national reach, working with UK Government Departments (e.g, DEFRA, Dept for Work and Pensions), national organisations (eg Public Health England and Natural England), and national charities (eg National Trust, Age UK, and RSPB).

1.4.4 HSR

Our HSR comprises a substantial portfolio of research that includes cutting edge methodological work (particularly in medical statistics, economic modelling, ethnographic research and PPI), as well as applied research that cross cuts CMH research priorities. In addition to the areas described above we have particular strength in diagnostics and stratified medicine and operational research.

The **Exeter Test Group** (*Hyde*) is an established centre of excellence in test evaluation working collaboratively with many other groups in the University and more widely. As well as contributing to the multi-million pound grant income achieved by PenTAG and PenARC, staff also hold grants themselves evaluating tests, such as screening for lung cancer with low dose CT and the reliability of point-of-care Hba1c measuring devices. The group works closely with Public Health England undertaking systematic reviews. We have a strong track record in methods research, particularly as related to better use of evidence in policy-making on tests. For example, we have recently been successful in a joint MRC project with the University of Birmingham on test evaluation (TEST - Test Evaluation Using Structured Tools). We have been closely involved with many international reporting guidelines on test evaluations, particularly the recently published PRISMA-DTA for systematic reviews of test accuracy, reflecting our close links with other centres of excellence across the world such as the University of Amsterdam.

PenARC has been designated by NIHR to lead nationally on **operational research** across the ARCs. Our operational research group, PenCHORD, undertakes national and international grant funded research e.g. NeoNet, providing a national demand/capacity model for neonatal care in England. We collaborate directly with health care organisations in Somerset, Devon and Cornwall to apply operational research tools such as modelling, simulation, forecasting and location analysis to address important regional service priorities (e.g the Health Foundation funded MindtheGap, a collaboration with Devon Partnership Trust, to close the communications divide between decision-makers and analysts in health care organisations). Key to our success has been focus on engagement between researchers and heath care clinicians and managers. Modelling work is embedded within a collaborative structure; effectiveness is measured in terms of the impact of outputs on local health policy and practice. Since its inception in 2010, PenCHORD has developed over sixty applied projects working in close collaboration with health-service organisations.

2.0 People

2.1 Environment and Culture, Equality, Diversity and Inclusivity

This UoA is deeply committed to equality of opportunity across all protected characteristics. EDI training is a key part of induction, mandatory for all staff, and refreshed every two years (in keeping with UUK Concordat). Such training forms a core element of routine performance development review and probation. Appointment panels are actively managed to ensure gender balance. Clear guidance is provided to panellists in respect of the use of language and panel documentation. Our College EDI Group has representation from all grades including ECRs, as well as PGR students.

We have an active approach to EDI to drive out racism, bullying, harassment, and discrimination of any kind. The College has Speak-Out Guardians, Dignity and Respect Advisors and sector-leading progressive parental-leave arrangements, return to work policies and a 24/7 staff wellbeing Employee Assistance Programme. Staff wellbeing is a key element of college life and opportunities include on-site exercise facilities (open before, during and after the normal working day). Staff at all levels are fully briefed on our annual employee engagement survey, with clear responsive action planning undertaken at College and Institute level. All staff involved in reviewing REF outputs have undertaken training in mitigating bias in decision making.

We are proud of our Athena SWAN Silver departmental award (awarded in 2014, renewed 2019). We take a careful, planned approach to EDI considerations which extends to staff appointment and support, career-progression, and in REF-output and impact case-study selection. All staff involved in key decisions and those with line-management responsibilities have undergone training in unconscious bias, highlighting all protected characteristics. Our ambition is to apply for Gold status within the next REF cycle. Through the Athena Swan programme, the college developed a pilot mentoring programme for both mentors and mentees. This has recently been further developed into the One Step beyond programme (**3.6 ILES**).

Women at senior level within the College have significantly increased since 2014, with an increase in the female professoriate from 22% to 37%. This follows the introduction of enhanced, tailored support and development for individuals as part of the promotions process, as well as a number of significant external appointments such as three Gillings Professorial Fellows, funded by philanthropic donation. We have also improved our pipeline for the future; women accounted for 63% of all promotions to Associate-Professor in the same period. We have recently adopted the BMA Race Equality Charter as a core element of UOA/College activity. To ensure achievement of our ambitions in respect of race/ethnicity, we have recently appointed a Race Equality Resources Officer alongside our existing Senior Academic Lead for BAME Students, and a member of our faculty has been appointed as the University's inaugural Associate Academic Dean for Racial Equality and Inclusion. EDI is a mandatory element of researcher training and in agenda for all research meetings and committees.

2.2 Employment

The profile of the UoA2 academic staff includes clinical and non-clinical research staff. Our human resources group adopt Concordat–working in setting of policy and practice for staff recruitment and development so that our recruitment, progression and promotions procedures are open, transparent and merit based. Managers undertake mandatory people management courses provided through the University's people development programme to ensure excellent people management (including annual appraisals and duty of care). We are conscious of the difficulties faced by researchers on fixed term contracts and have launched our FEFA (Fair Employment for ALL) promoting open-ended over fixed term contracts (**3.1 ILES**). For those coming to the end of their contracts, we have a policy that ensures they are offered an interview for any upcoming research vacancies, and recruitment policies that ensure income preservation through early-career research appointments.

2.3 Professional and Career Development

Staff development is at the centre of our activities and fully aligned with Exeter's institutional policies including the 'Exeter Academic' Framework and the Academic Professional Programme; (**3.3-3.13 ILES)**. Staff are allocated a senior line manager to support career development, and we have a robust annual e-Personal Development Review process, involving open discussion round with staff and outlining further training or learning opportunities which might support career progression and promotion. In addition, we offer a process of externally supported 360-degree review for senior staff. During the period *Greaves, Wyatt, Ford Green,* and *Henley* were promoted to Chairs and *Thompson Coon, Pitt, Spencer, Llewellyn, Anderson, Medina-Lara and Garside* to

Associate Professorships. *Thompson Coon*, *Pitt*, *Llewellyn and Spencer* have subsequently been promoted to Chairs.

The Institute Director holds a budget for staff development, and staff of all grades have opportunities to develop their skill set by being involved in teaching, outreach, public engagement and both CMH and University committees. Those at early stages of their careers participate in the researcher development programme (**3.8 ILES)**, including exposure to non-academic career options and a realistic self-appraisal. CMH benefits from a vibrant, well led Early-career researcher group who provide regular input to senior team meetings, raise awareness of opportunities and training, and facilitate collaborative problem solving within CMH. Early-career researchers (ECRs) and research students can apply for funds for Researcher-led Initiatives to develop and deliver transferable skills training such as 'The Bees Knees' – where PGRs facilitate Data and Discourse Bees to share and problem-solve qualitative analysis issues. Early-career staff and students are encouraged and supported to develop their academic skill set through involvement in College Ethics Committee or working group membership, Masters supervision and undergraduate teaching and small group facilitation.

A mid-career Group for Senior Lecturers/Research Fellows, Associate Professors and professional Services staff was established in 2018 with funding from the CMH Equality and Diversity group. This enabled an external facilitator to run two Action Learning Sets which have continued to run, self-facilitated by the groups.

To develop grant writing skills, we have learning and development courses, mentorship is provided and peer review given by the Institute Directors and senior research staff. Annual competitions are held for places at a 3-day residential research school with the NIHR Research Design Services, to receive intensive feedback on grant applications. Opportunities to attend a 2-day annual *off-campus* writing retreat enable staff to work on grant proposals and papers. Staff are supported to attend leadership programmes and training, both in house and external training. Since 2013, 20 IHR staff have attended the Aurora programme.

Methodological clinics run regularly to provide staff and students with additional methodological support and advice. Ethics training and support is provided by the various members of the CMH ethics committee and NHS R&D staff and supported by academic staff providing methodological reviews of ethics proposals before submission.

International collaboration is actively encouraged and supported by travel funding. Within CMH this has included 15 Outward Mobility Awards since 2015 enabling staff to carry out research internationally (for example, *Smith*, Australia; *Bell,* Fiji; *Llewellyn*, Hong Kong); there is designated Early-career Research funding for research visits (for example, Australia, Germany, Netherlands, Sweden, Italy); and 40 Internationalisation awards from the UoE Internationalisation and Impact Fund (for example, *Green,* Sweden; *Thompson-Coon*, Canada). The awards have led to the development or further development of successful international collaborations. Examples include *Hyde* (award in 2019 from Europe Network Fund) which has led to an application to the MRC on extending the principles of evaluating complex interventions to tests with the University of Amsterdam; and *Green* (award from the Internationalisation Fund in 2016) who is currently working on economic modelling in Alzheimer's with colleagues in the Karolinska Institute.

The success of our Professional and Career Development activities is clear. We have seen staff progression from ECRs to professorial positions (*above*) including moves to other prestigious universities (for example, *S Richards* who now holds a Chair at the University of Leeds). An example of staff support and progression for ECRs is *Morrish:* following appointment to a Graduate Teaching Assistant, *Morrish* has been supported to successfully apply for a NIHR pre-doctoral fellowship and subsequently a NIHR Doctoral Fellowship. In the most recent round of NIHR applications we supported four mid/early-career researchers in Advanced Fellowships (*Hawton, Cockcroft, Dooley* and *Nikram*), one NIHR ICA Senior Clinical Lecturer award (*Wright*) and have had one member of staff begin their NIHR Advanced Fellowship Award (*Russell*).

An action plan based on the 2018 Employee Engagement Survey and open staff meetings included improving clarity of line management responsibilities and additional support for promotion applications which has resulted in a pro-rata increase in promotions in CMH over the first 5 months of 2020.

2.4 Research students

PhD students are critical to the vibrancy and success of a strong research community. We place great emphasis on the recruitment, education, support and development of our PhD students; (**3.10-3.13 ILES**). In the REF period, the CMH has had 106 doctoral completions compared with 54 in the previous REF period. This has been supported by the award of a doctoral training centre by Alzheimer's Research UK, success in the regional MRC-funded GW4 (Universities of Exeter, Bristol, Bath, Cardiff) PGR programme, award of 13 studentships as part of the Research England Expanding Excellence in England initiative, and 12 studentships as part of NIHR PenARC - evidence that CMH is committed to maintaining high completion rates and to increasing the numbers of PhD students.

Currently, we have 226 registered PhD students with a wide international reach, including students from Saudi Arabia, Qatar, Canada, India, Malaysia, Uganda, Nigeria, Iran, Ukraine, South Korea and China. We are keen to encourage clinicians from all disciplines to develop research careers and support applications for PhD Fellowships and pre-doctoral awards to enable them to develop strong application for PhDs. We have a PhD fee bursary scheme for NHS staff and our thriving Academic Clinical Fellows (ACF) programme provides a platform to gain experience and develop projects and applications for PhD training positions. We currently host 20 ACFs and 7 ACLs (3 locally funded).

Prospective PhD projects and candidates are rigorously reviewed by CMH research-degrees committee and UoE Doctoral College, which also ensures good student supervision through regular reporting mechanisms, the adoption of a structured e-log to monitor supervision, and formal upgrade presentation and viva within the first 10 months. CMH Director of Postgraduate Research Studies and the three deputies provide oversight and support for PhD students, are charged with leading appraisal and subsequent action planning following publication of the Post Graduate Research Experience Survey, and organising the annual residential research event (online in 2020). The residential opportunity is free of charge to students, who give a 10 minute presentation and discuss their projects with a large group of senior members of staff. PhD students and junior research staff are encouraged to attend training courses, as well as seminars within the IHR and elsewhere in the region. Generic skills training is facilitated by the UoE Doctoral College and supplemented by courses to address the specific needs of the student as identified at initial skills review and annual update reviews.

We host an annual away-day for all staff and research students, and regular seminars which research students are encouraged to attend. There are several journal clubs, study groups, and training days run for research students by staff members with a particular interest in a specific methodological approach or area of expertise. An example is the community of practice established for the PenARC PhD students studying dementia care, or the monthly APEx(Primary-care) seminars attended by 35-40 individuals. In the case of the PenARC community of practice, groups became self-sustaining, providing support for attendees through activities such as screening for systematic-reviews and coding for qualitative research, frequently resulting in co-authorship opportunities. On-line seminars and innovative solutions including on-line workshops with break out rooms have been instigated in response to the pandemic restrictions to enable these initiatives to continue to flourish.

Interdisciplinary supervision is actively encouraged to include both methodological and topic specific expertise, as well as cross-college and cross-institution supervision. Methodological

clinics (search and review, statistics, qualitative research, health economics and PPI) run regularly to support students.

The wellbeing of PhD students is further enhanced by the UOE wellbeing service, including a dedicated post graduate research student wellbeing advisor, and with experts available to provide a range of support services for personal problems or emotional difficulties, mental-health advice and support and information about self-help and peer-support resources at the University. Peer-to-peer support is encouraged by networking, seminars, the residential research events and the open-plan coffee areas on the St Luke's Campus, Exeter and the Knowledge Spa in Truro which encourages informal discussions and mixing of students and staff. Each student also has a named pastoral-tutor.

3.0 Income, infrastructure and facilities

3.1 Research income and support

Our strategy remains firmly aligned to the strategic aims articulated in our 2014 REF submission. These goals are held in constant focus and have underpinned our expansion, allowing us to sustain world-leading research driven by important health questions and supported by our collaborative, interdisciplinary methodological work and applied health research that reflects the needs of both health-service providers and patients. We have seen a significant rise in research activity and output within CMH and UoA2. UoA2 research-awards between 2013/14 and 2018/19 valued £81.17M representing 590 awards including major project-grants, fellowships and infrastructure support (e.g. NIHR, £44M), major charities (e.g. Wellcome Trust, CRUK) and a growing UKRI base (£6.6M). This has resulted in a significant increase in the average annual income, £8.3M compared to £5.8M over the last cycle. While this reflects our growth in FTE, the unit's income per FTE in the last two years of the period increased also to £156k; with an average for 2015-20 of £144k.

Key to continued grant success is a process of rigorous internal peer review. Staff are encouraged to present their ideas at regular "pitch and putt" events as grant and fellowship proposals are developed, providing an opportunity for colleagues and peers from multiple disciplines to provide early feedback via a critique of the research plans and proposed methodologies.

The substantial investment in methodologists means that all staff have access to their skills early in project development. Each of these groups runs "Clinics" where researchers can discuss ideas. We ensure that this help is appropriately recognised within grant applications, and in staff performance review so that methodologists are treated as partners in the research process.

All applications are reviewed by appropriate researchers outside the team within IHR and by the Director before submission. Practice interviews, with panels of varying composition (for fellowship candidates) and comprehensive mentoring and review (for all staff) ensure that final submissions are of the highest quality. The NIHR Research Design Service South-West (RDS-SW) also supports investigators developing grant applications to national peer-reviewed funding competitions, giving priority to submissions to NIHR funding-streams. In addition to the day-to-day activity of consultations with investigators, the RDS-SW offers a formal process of grant application review through its Project Review Committee (PRC), which acts as a mock funding committee and includes Lay as well as methodological expertise.

Support is also provided by our in-house Funder Advisory Networks (FAN) which cover: AHRC, BBSRC, EPSRC, ESRC, GCRF, Leverhulme Trust, NERC, NIHR, MRC & Wellcome Trust, Europe/International and Industrial Strategy. FANs provide an informal setting for sharing early funder intelligence, a pool of funder-expert peer reviewers, and the leadership to bring together and support research communities applying to the funder.

Open access and research integrity

Across each research theme, our work is pursued to the highest standards of scientific, scholarly and professional integrity (**2.9 ILES**) conforming to University and health research ethical policy and frameworks. Support is provided from UOE online Research Toolkit, CMH ethics committee and the University Integrity, Ethics, Animal Welfare and Research Governance processes (**2.9 ILES**). We actively promote an open research culture, advocating and supporting open-access principles in scholarly communication and actively managing (100%) ORCID registration. The University Open Access team (**2.8 ILES**) manage the institutional repository and research data services to provide open-access to research datasets. Institutional subscription to major health research publishers (e.g BioMed Central and Springer) has resulted in discounted or no cost open access publishing, accelerating the visibility and accessibility of our research globally. IHR has deposited 6 datasets in the University's ORE. IHR has seen substantial growth of ORE downloads, from c.5k in 2014 and 2015 to c.40k in 2018 and 2019, with domination of requests from USA (99k downloads, 59k views), UK(57k,39k), Germany(19k,17k), China and Australia. The Unit has also seen growth in the 'Request-a-Copy' feature in ORE, in operation since November 2018. This allows individuals to request a copy of a work which is under embargo. At College level we have 165 embargoed deposits, of which 34 were requested at least once in the year of 2019.

3.2 Infrastructure and facilities

The College strategy aims to provide state-of-the-art platform technologies in order to promote and sustain the activities of multiple researchers. This has included:

- The establishment of the Exeter Clinical Trials Unit in 2015, and the establishment of the Joint Research Office bringing together local NHS-research and academic interest have substantially increased our ability to deliver large scale clinical trials. Our expansion continues with the appointment of *Creanor* as CTU Director in 2020 and was further facilitated by the move of *Taylor* and the RDS-SW to Exeter in 2018 (see section 1.2.3.1).

- The Biomedical Informatics Hub (The Wellcome Trust £1.5M) is a virtual hub to help maximise output from emerging technologies and large datasets. It supports highly-talented emerging researchers to generate preliminary data in support of independent fellowship and research project grant applications. It is staffed by some of the most talented researchers in their fields, who have recognised that the analysis of datasets, both large and small, is the key bottleneck for many research projects.

Facilities developed in REF period to facilitate and enable high quality research include:

- Refurbishment (2015) of South Cloisters and College House buildings on the St Lukes campus (3710m^2) providing purpose-built accommodation for researchers (£12.48M UoE investment) designed to enhance team-working and facilitating interdisciplinary collaboration.

- The Wellcome-Wolfson-MRC (7535m^2) opened in 2014 in collaboration with the RD&E Hospital NHS Foundation Trust. (£27.5M, including £4.75M Wellcome-Wolfson Biomedical Capital Award). Incorporates expanded NIHR Clinical Research Facility (CRF) (5 year renewal of NIHR infrastructure funding in 2017, £5.27M) comprising 3 four-bedded wards, exercise suite, research outpatients and individual intensive study rooms, staff offices, seminar rooms and a new Postgraduate Education Centre.

- A state-of-the-art multidisciplinary VSimulator funded by EPSRC (£4.5M) and UoE (£7.2M), (opened 2020) part of a 1200m^2 new research facility at Exeter Science Park, comprising a 4x4m motion platform, virtual reality technology and motion capture used by academics and industry to support multi-disciplinary human factors research and innovation with a key theme on health and wellbeing.

- The Wellcome Centre for Cultures and Environments of Health (opened 2017); an interdisciplinary centre bringing together the humanities, social sciences and health to foster transformative, engaged research to create and sustain cultures that enable health and well-being across the life course (£7.1M including funding from the Wellcome Trust and matched funding from UoE). A WHO collaborating Centre on Cultures of Health is also part of the Centre.

- Computational modelling and analysis of big data are supported by high performance computing (HPC) which now encompasses a total of 360 modes across the University (90 of which are dedicated wholly to the support of medical research). The system was designed and integrated by HPC storage and analytics integrator OCF, using Lenovo, DDN and Mellanox technology. It provides CPU performance of 250 TFLOPs and incorporates Intel MIC accelerators totalling 2.3 TFLOPs and GPU acceleration totalling 11 TFLOPS.

- A new Neuroimaging centre opened late 2019 with a 3TMRI and a PET scanner supported by the Gillings foundation, with the new director (*Politis*) already achieving more than £6M of funding from major international organizations (including the Michael J Fox foundation) and commercial partner for Parkinson's disease cohort studies focussing on novel PET ligands and people with risk genotypes.

4.0 Collaboration and contribution to the research base, economy and society

4.1 Overview

Societal impact is at the centre of our research strategy and asking the questions that really matter to the users of evidence is a key component of this strategy. We aim to improve the health of our population and the quality of services so have established explicit processes to engage with members of the public, service users and those who provide services relevant to health and social care, both individual practitioners and organisations. In addition, we have established major scholarly activity researching optimal approaches to engaging with the public and with users round research strategy, design, delivery, and dissemination.

4.2 Patient and Public Involvement

Our PPI team is considered exemplary and world leading, with numerous international visitors to the programme, and with Dutch (NIHR) recognition of programme-excellence. We have made a substantial investment in staff dedicated to the promotion and support of PPI who can expert help researchers. Members of the public and service users are involved in all our activities including selecting research questions, designing and conducting studies and analysing and disseminating results. We achieve this engagement through a variety of routes. We have some well-established PPI groups associated with particular areas of research such as PenPIG (http://clahrc-peninsula.nihr.ac.uk/penpig) linked to PenARC and the Family Faculty which is part of PenCRU (http://www.pencru.org/getinvolved/ourfamilyfaculty/). In addition, studies often involve service users as grant co-applicants and co-investigators. (see also section 1.2.1)

4.3 Providers of health and well-being services

Especially, but not only, the NHS, are major users of the research we generate. Thirteen staff provide direct clinical services for the NHS. Close working relationships exist at both organisational level and between research groups and relevant clinicians and organisations. In addition to the inevitable close relationship between CMH and NHS organisations, PenARC is a partnership between the University and all NHS organisations within the wider area. The relationship with the Academic Health Science Network (AHSN) is particularly strong with joint projects aimed at producing research and achieving service improvements in the NHS. The organisations are represented within its management structure and there is an explicit system through which

organisations and practitioners feed into the research programme. This is enhanced by extensive capacity building activities including programmes such as "Making Sense of Evidence" and the "Health-service Modelling Associates". These activities not only enhance the pool of individuals in the local health economy with skills to work with us on research and help to ensure that we address questions likely to produce impact but also develop a cadre of practitioners and policy makers better equipped to foster impact through use of evidence.

Other organisations which are important in the context of health and wellbeing include Local Authorities, Schools, the Police, and private sector providers such as Care-Homes. We have developed explicit links with each of these groups. Devon and Cornwall Police have become particularly strong collaborators with the University working with the College of Policing to provide training in the effective use of research evidence within the criminal justice system and in the establishment of the "Police Lab" which brings together practitioners and researchers from across the university to generate research projects. Care homes are an important location for attempts to improve health in the elderly and we have established a close relationship with a network of local independent care homes, the Exeter Care Homes and Knowledge (ExCHANGE) Collaboration, supported by funding from the Alzheimer's Society. This is a collaboration between UoE, PenARC, SW AHSN, and the Devon Care Kite Mark (DCKM) group. DCKM is an established group of over 50 independent care providers committed to improving the lives of those living in their care through a programme of continual review and improvement including peer inspections, learning events, and training. The ECEHH has strong links with our local community, engaging with over 150 local businesses and not-for profit organisations, working with local public health teams across the South West (as well as the Greater London Authority) and our SW NHS Trusts. We also have national reach working with bodies such as Government Departments (for example, DEFRA, Dept for Work and Pensions), national organisations (such as Public Health England and Natural England), and national charities (for example, the National Trust, Age UK and RSPB).

4.4 National and International Collaborations with HEIs

Academics in UoA2 have extensive collaborations with universities across the UK and internationally. These collaborations have resulted in many jointly authored outputs, grant applications and implementation of research outcomes as demonstrated in previous sections of the application. Between 2014 and 2019, we increased our international HEI jointly-authored outputs from 57 to 147 (+158%), and UK HEI jointly-authored from 130 to 219 (+68%). Our international reach and collaboration is also exemplified by our representation on international boards and panels. These include: *Green* member of the International Dementia Advisory Group (University of Washington) and member of the international Pharmacoeconomics Collaboration on Alzheimer's Disease (Karolinska Institute); *Smith*, member of international scientific panels for genomics and AMR in Canada; *Campbell* (international steering committee Canadian TRANSFORMATION). The ECEHH is internationally recognised for its work, recently being designated a WHO Collaborating Centre in Natural Environments and Health. The Centre has a global network of partners, reaching across lower and higher income countries in North and South America, Asia, Africa, Australia, and Europe.

Nationally, PenARC has been an active participant in the network of NIHR ARCs with *Logan* acting as the ARC representative on the NIHR Strategy Board (2014-present). This network has spawned a number of cross-ARC groups in both substantive (for example, Child Health, Ageing, Dementia) and methodological areas (for example, Health Economics, Operational Research Modelling, PPI) which have led to joint grants. With the establishment of PenARC, we have developed a "Tri-ARC" partnership with the NIHR ARC North Thames and the NIHR Yorkshire and Humber ARC to ensure that we can conduct research across the diverse populations of these 3 regions, enhancing the likelihood of wide applicability of findings. This will also increase access to a wider range of skills for our staff with, for instance, North Thames providing strength in Public Health, and Yorkshire and Humber in Frailty. Six joint-funded PhD studentships have been established to cement the relationships.

4.5 External engagement

4.5.1 Contributions to UK government and health organisations

We contribute to a wide range of Government departments and health organisations. We are closely involved in NICE Guideline development. For example, *Hamilton,* clinical lead for NICE referral guidelines for suspected cancer; *Allan*, NICE Guideline Development Committee for Dementia; *Garside*, reference group for the 2017 NICE guidelines update on use of qualitative evidence in guideline development; *Hyde* vice-Chair of the NICE Diagnostics Assessment Committee and member of the UK National Screening Committee; *Valderas*, NICE Appraisal working group 2018/9. Nationally we also feed into policy and practice, for example *Campbell, Abel* member of the Secretary of State commissioned expert group on developing individual GP focused metrics for primary-care and a member of the CQC Advisory Board; and *Hamilton* Task & Finish Group overseeing the design of Rapid Diagnostics Centres in England and member of the Cancer waiting times redesign group for the Department of Health in England.

4.5.2 Research funding (panel membership and review responsibilities)

We are widely represented on research council funding panels. Examples include: *Campbell* NIHR/UKRI Long COVID-19 call**;** *Logan*, NIHR Policy Unit Research Units (PRU) Commissioning Panel, chair NIHR PRU panel and NIHR School of Primary Care Research panel. *Stein*, Director of the NIHR Evidence Synthesis Programme. *Lamb* has held numerous senior positions within NIHR including Chair, Health Technology Assessment (HTA) Clinical Trials and Evaluation Board. *Creanor*, Chair NIHR: Research for Patient Benefit Programme (RfPB) South West Regional Funding Committee. *Green, Taylor, Thompson-Coon, Medina-Lara* NIHR HTA boards; *Taylor* chair of the NIHR of the HSDR Researcher led panel; *Hamilton, Hulme and Ukoumunne* NIHR Programme Grants for Applied Health Research; *Hulme* NIHR Invention for Innovation (i4i) Programme and NIHR Social Care for Patient Benefit panel. Representation on research councils include: *Russell* and *Smith* (Chair) ESRC Research Grant Board; *Smith* Chair ESRC Secondary Data Analysis Initiative; *Taylor* Co-chair MRC Methodology Research Programme. Similarly we have a wide reach in 3rd sector funding panels for example: MS Society Grant Review panel (*Green, Hawton*), Chartered Society of Physiotherapist Scientific Panel (*Hulme*). For capacity and methods development, examples include: *Spencer*, MRC Skills Development Panel and NIHR Development and Skills Enhancement Award Selection Committee; *Taylor* and *Hulme* NIHR Incubator in Methodology group; *Lamb*, deputy chair NIHR Clinical Scientist award panel; *Hulme* HEE/NIHR Integrated Clinical Academic Programme.

4.5.3 Journal editing

Our academics routinely undertake peer review of manuscripts and service on editorial boards of many national and international journals. Editorial positions include:

- *Anderson*, Cochrane Public Health Group; *Hamilton*, Family Practice; *Logan*, Child: Care, Health and Development; *Pitchforth*, Globalization and Health; *Lovell* Health People and Nature; *Lamb*, Physiotherapy, Journal of the Chartered Society of Physiotherapy; *Smith*, Social Science & Medicine, Health Economics, Annals of Tropical Medicine & Public Health; *Taylor*, Revista de turism, Ecoforum; *Thompson-Coon*, Systematic Reviews, PLoS ONE, *Campbell* Social Welfare Co-ordinating Group; *Valderas*, Quality of Life Research, European Journal of General Practice, Journal of Patient Reported Outcomes, Journal of Comorbidity; *Green* PLoS One; *Pitt,* Health Systems Journal

4.5.4 Conference and symposia activities

Our staff regularly present at international symposia, with a significant number being invited to give keynote presentations. The following illustrate the breadth of staff invited to present keynote lectures:

- *Russell,* ADHD Foundation Annual Conference (2015)
- *Anderson*, 1st International conference of Realist Research (2016)
- *Lang,* Alzheimer's Society Annual Research Conference (2017)

- *Bell,* International Society for Physical Activity & Health Congress (2018)
- *Newlove-Delgado*, World Congress of the International Association for Child and Adolescent Psychiatry and Allied Health Professions (2018)

We are involved in organisation of national and international research dissemination events, for example *Smith*, held three organised sessions on: Economics of Obesity, Evaluating Taxes on Sugar-Sweetened Beverages, and Antimicrobial Resistance at the 13th World Congress of the International Health Economics Association, Basel, 2019. *Pitt* organised the National conference in Planning the Effective Transformation of Healthcare through Operational Research and Advanced Analytics 2018 in London. In 2019 APEx hosted the 47th annual meeting of the UK Society for Academic Primary Care with 400 national/international delegates, the first occasion for Exeter to host this conference, and benefitting from outstanding conference facilities at our Streatham Campus.

4.5.5 Awards, prizes and fellowships

Examples of awards, prizes and fellowships across staff include:

- New Year's Honours List: *Ford* CBE 2019 (services to psychiatry); *Hamilton* CBE 2018 (improving early cancer diagnosis); *Goodwin* OBE 2017 (IHR&UOA3) (physiotherapy); *Campbell* MBE 2020 (General Practice).
- NIHR Senior Investigators: *Logan, Taylor, Dieppe, Lamb, Stein*. *Dieppe and Lamb* were subsequently appointed NIHR Emeritus Senior Investigators in this cycle.
- *Ballard* and *Lamb* are Fellows of the Academy of Medical Sciences. *Lamb* is a Fellow of the Chartered Society of Physiotherapy. *Llewellyn and Monks* are Alan Turing Institute Fellows.
- Our early-career and mid-career researchers have been successful in a range of doctoral and post-doctoral awards including: NIHR Advanced Fellowship (*Newlove-Delgado, Russell*); DEFRA Social Science Research Fellowship (*Lovell*); The Health improvement Studies Institute Post-Doctoral Fellowship (*Manzi*); NIHR Knowledge Mobilisation Research Fellowships (*Maguire, Lang*); College of Radiographers Doctoral Fellowship (*Meertens*); NIHR Doctoral Fellowships (*Newlove-Delgado, Butterworth*).
- Awards in research and practice include: *Ballard*, 2019 Weston Brain Institute International Outstanding Achievement Award; *Newlove-Delgado*, 2018 RCPCH/British Academy of Childhood Disability Paul Polani Prize; *Pitt*, Operational Research Society Presidents Medal (2017) for development of the Health Services Modelling Associates Programme for impact in capacity building in the NHS; Clinical excellence awards held by *Campbell, Logan* (Gold), *Stein, Valderas, Hamilton* (Bronze); *Campbell* 2014,2017 RCGP Richard Scott and Mackenzie lectures/medals; *Hamilton,* 2019 CRUK Anniversary Awards, People's Choice Award.

Summary

The University of Exeter has invested deeply in staff, infrastructure, and resource to develop our activity and profile in Public Health, Primary Care, and Health Services Research. UoE remains committed to further strategic expansion in these key areas of importance to health care planners and health system providers, with a view to growing depth, extending scope, and increasing reach in this exciting core set of activities. We remain ambitious for further success and growth amongst this burgeoning group of highly talented individuals and the research groups contributing to this unit of assessment.