

Institution: Glasgow Caledonian University
Unit of Assessment: 3 – Allied health professions, dentistry, nursing and pharmacology
1. Unit context and structure, research and impact strategy <u>1.1 Overview</u> <p>Glasgow Caledonian University has a long tradition of conducting a wide range of multi-disciplinary applied health research that is economically and socially relevant – applying new knowledge to problems of global significance.</p> <p>The research activity at GCU for UoA3 stems from the university research strategy, as described in the institutional environment statement. Like all research at GCU, it is aligned to the United Nations' Sustainable Development Goals (SDG). For UoA3, the primary SDG is SDG 3 (Good health and wellbeing), although it also aligns with SDG 4 (Good Education), and SDG 6 (Clean water and sanitation), as well as with SDG 10 (Reduced inequalities) and SDG 17 (Partnerships). Within the scope of SDG 3, research for UoA3 is shaped by the distinctive GCU mission "For the Common Good", applying health research which seeks to impact directly on the lives of individuals and communities, as demonstrated by our Impact Case Studies (ICS).</p> <p>The REF2021 assessment period was characterized by expansion and evolution from the Institute of Applied Health Research (IAHR) into a new entity, the 'Centre for Living', which has been officially re-branded as the Research Centre for Health (ReaCH) in order to articulate the purpose of our work more emphatically: to reach out into communities to understand what their real problems and uncertainties are; to work collaboratively and reach out to other institutions, as well as health and social care professionals; and to make sure our research is based on current, high-quality evidence underpinned by international bodies of literature.</p> <p>ReaCH is organised into two research programmes, with a total of nine research groups contributing to these programmes:</p> <ul style="list-style-type: none"> • <u>Public health (PH)</u>, comprising the five research groups: Sexual Health and Bloodborne Viruses (SHBBV); Safeguarding Health through Infection Prevention (SHIP); Substance Use; Child and Adolescent Health; and Ageing Well. • <u>Long-term conditions (LTC)</u>, comprising the four research groups: Musculoskeletal Health; Living with Stroke and other neurological conditions; Vision Science; and Biological Mechanisms of Diabetes and other long-term conditions. <p>Two other GCU entities are integrated within ReaCH groups and contribute extensively to the research covered in this UoA: the Nursing, Midwifery and Allied Health Professions Research Unit (NMAHP-RU), and the Yunus Centre for Social Business and Health.</p> <p><u>Nursing, Midwifery and Allied Health Professions Research Unit (NMAHP-RU)</u></p> <p>The Unit is co-hosted by GCU and the University of Stirling, with core grant funding from the Scottish Government's Chief Scientist Office (CSO). The NMAHP-RU activity focuses on three programmes: i) Innovation in NMAHP Interventions, ii) Transforming Care Delivery and iii) Maximising Data Usage in NMAHP Research. These programmes of research enable the Unit to respond to and address a wide range of healthcare and clinical problems. This also involves understanding the behavioural (patient and practitioner) and computerised (system) influences on intervention development and uptake to enhance the implementation and translation of evidence-based solutions into practice. Although NMAHP-RU addresses many clinical areas, much of the work is currently focused on stroke, pelvic health, maternal and child health, long-</p>

term conditions (including mental health), population health, and innovation in systems, services and roles. In total, 19 NMAHP-RU staff are employed by GCU (totaling 14.6 FTE), and 10 of them (8.4 FTE) have been included in this REF submission.

Yunus Centre for Social Business and Health

Cutting across the main societal challenges targeted by the GCU research strategy, the Yunus Centre is clustered into three research themes: i) Social Economy; ii) Community, Citizenship and Participation; iii) Economics of Health and Wellbeing. Much of the research conducted by members of the Economics of Health and Wellbeing team is included in UoA3. This research focuses on how best to allocate scarce resources from a societal perspective, assessing initiatives within the health and social care system, the third sector, as well as in communities and households, with the purpose of improving population health and wellbeing. This work is largely conducted in collaboration with research teams from ReaCH and NMAHP-RU, generally through the inclusion of health economics in clinical trials. Five members of staff (4.8 FTE) in the Yunus Centre have been included in this UoA3 submission.

1.2 Progress since 2014

Since REF2014, a significant expansion has taken place in the research undertaken at GCU within UoA3. As shown in Table 1, both in terms of people and grants, this REF submission covers a much larger effort than in 2014.

	N of staff returned in Cat A	Total FTE returned	Average annual grant income (M£/y)	Research doctoral degrees awarded (N)
REF2014	51	44.3	2.24M	91
REF2021	99 (+94%)	89.6 (+102%)	3.68M (+64%)	158.58* (+74%)

Table 1: comparison of people and grants, GCU UoA3 REF2014 and REF2021. (*: in some cases, studentships are counted partially as they were co-supervised with staff from other UoAs)

The evolution of the Unit since our REF2014 submission has provided continuity in our areas of research excellence while significantly strengthening stakeholder engagement and involvement. As described above, there has been a greater focus on research co-creation with service users (patients and citizens) and providers (NHS, social enterprises and community groups). This has translated into seven key objectives, approved within the ReaCH strategic plan:

- Consolidate and grow our world-leading thematic programmes in Public Health and Long-Term Conditions research targeting, high-quality external funding in support of actions and activities that are relevant, informed by need, and have international reach and significance.
- Provide world-class infrastructure necessary to develop and deliver impactful research focused on transforming the lived experience of individuals and communities and, through that, their health and wellbeing.
- Work in partnership to develop an exemplar model of public and patient involvement (PPI) and community engagement with research, grounded in best evidence, which can create pathways of impact locally, nationally and globally.
- Promote the knowledge triangle of 'Research-Education-Innovation' to inform the education of the public, and future health and social care practitioners, to significantly extend capacity and capability in the current and future health and wellbeing workforce.

- Harness the intellectual capacity of our staff and students to consider problems led and/or informed by citizens or communities to address major health and social challenges, creating local solutions to global problems.
- Widen access to facilities and expertise to all who can benefit (for example through new strategic partnerships).
- Create the environment, physical facilities and use of technology that encourages integration and partnership working between University staff and students and the diverse communities we serve, embedding the university and its resources within the community.

Over the last six years, the Centre has successfully met its objectives:

- Annual income from external grant funding has increased by 64%, with a significant increase in large NIHR and other clinical trials funding.
- Infrastructural improvements have been made with the appointment of a Senior Clinical Research Governance Manager to advise research staff and students and oversee research integrity.
- An academic lead for PPI development (Hendry) was also appointed as well as two research impact officers (non-academic, one centralised and the other dedicated exclusively to work carried out by ReaCH), in order to establish, maintain and expand partnerships for research co-creation with governmental and non-governmental policy groups (e.g. Health Protection Scotland, World Health Organisation, European Centre for Disease Control), medical and health charities (e.g. Versus Arthritis, Fight for Sight), community groups (e.g. Fibromyalgia Friends) and industry.
- The long-standing association with Health Protection Scotland (HPS), now Public Health Scotland (PHS), has intensified further, as evidenced by the return in this REF submission of a number of researchers undertaking PHS priority work, including at professorial level (Goldberg, Hutchinson, Reilly, Currie, Price). PHS is one of the NHS Scotland National Services (NSS), with a remit to protect Scotland from infectious and environmental hazards. The GCU work presented in this REF submission on antimicrobial resistance, healthcare associated infection, blood-borne viruses, and sexually transmitted infections is closely aligned to and integrated with PHS/NSS. Work in these areas has expanded significantly over the course of the current REF assessment period.
- Establishment of a formal collaboration with NHS Lanarkshire, giving university hospital status to Monklands, Hairmyres and Wishaw General Hospitals, with GCU staff working on site as clinical academics and NHS staff working as co-investigators at and with GCU. Similarly, close and formal collaboration was established with NHS Greater Glasgow & Clyde Sandyford sexual health services, including a professorial clinical-academic post for an NHS consultant (Estcourt).
- A formal collaboration is in place with the Hampden Sports Clinic, with GCU podiatry and physiotherapy staff actively involved in delivering research impact and co-creating new research.

1.3. Achievements of particular research groups

More specifically, there have been a number of achievements within each of the research groups working as part of ReaCH.

1.3.1. Public Health

The Sexual Health and Bloodborne Viruses (SHBBV) group has:

- Generated the key evidence underpinning the Scottish Government's globally computerised strategy on Hepatitis C.
- Provided the evidenced-based strategy that led to the World Health Organisation (WHO) and the patient-led World Hepatitis Alliance staging their inaugural World Hepatitis Summit in Glasgow during 2015 (computerised by Goldberg, Hutchinson) with 500+ delegates from 84 countries involving 46 governments.
- Been cited as an example of best practice by WHO (at the inaugural World Hepatitis Summit in Glasgow, 2015).
- Informed the national strategy on computerisation of expensive new hepatitis C therapies, which thereafter yielded the first country-level evidence of major health benefit of these therapies in reducing severe liver complications (~300 liver failures averted in four years, translating to £30 million saving to NHS) that underpins Scottish Government's commitment to eliminate Hepatitis C by 2024 (see Section 4.2.2 below, ICS1) (Hutchinson, Goldberg, Innes).

Additionally, the SHBBV Group informed Scotland's 2030 HIV transmission elimination strategy (Estcourt, Hutchinson, Goldberg, McAuley, Yeung, Frankis) (see ICS3 in Section 4.2.2), and delivered a programme focusing on reducing transmission of sexually transmitted infections (STIs) and reducing undiagnosed HIV: the LUSTRUM project (Estcourt); and a proof-of-concept eSexual Health Clinic, which contains our world-first online automated prescribing consultation for the treatment of chlamydia, which featured as a case study in The Topol Review (2019), an independent review for the UK Government on preparing the healthcare workforce to deliver a digital future (Estcourt).

The Safeguarding Health through Infection Prevention (SHIP) group:

- Was a key partner in the Scottish Healthcare Associated Infection Prevention Institute (SHAIPi) consortium, a collaboration of Scottish Universities to promote excellence in interdisciplinary research in healthcare associated infection. Reilly, Price and Currie led the Applied Infection Prevention and Control work stream of the consortium. Outputs from this workstream contributed to impact in relation to improved compliance with screening and reducing in healthcare associated infection; improved validity of the European Centre for Disease Prevention and Control's healthcare-associated infection survey methodology; evidence to underpin WHO Guidelines for Core Components of national infection prevention programmes (see ICS2 in Section 4.2.2).
- Established, managed and supported a public involvement group that contributed to research development across the SHAIPi.
- Delivered a programme of behavioural insights work focusing on a 'One Health' approach to antimicrobial stewardship across human and animal populations, with resultant influence on Scottish antimicrobial resistance policy (Flowers, Currie, Price).
- Completed a complex mixed methods study "Evaluation of Cost of Nosocomial Infection", investigating the cost and impact of Healthcare Associated Infection to patients, the health service and the wider community (Reilly).
- Undertook wide and innovative public engagement events on hand hygiene and antimicrobial resistance including activities at Science Festivals, and local community

centres, housing associations and schools. The reach and significance of this work has been recognized by Price being invited in 2019 to present evidence on the group's public engagement activities to the US Presidential Advisory Committee on Combatting Antibiotic Resistant Bacteria meeting.

The Substance Use group has:

- Initiated and progressed qualitative research which explores the impact of alcohol availability (i.e., changing numbers of alcohol outlets in neighbourhoods, later opening hours for bars and clubs) on diverse social groupings (e.g., gender, LBGT, older adults, the homeless) (Emslie). This work has had a direct influence on alcohol policy in Scotland.
- Informed proposals by the Glasgow City Health and Care Partnership to open the UK's first drug consumption room. Evidence presented to the Scottish Affairs Committee, received extensive international media coverage and was quoted directly by the First Minister in the Scottish Parliament (McAuley).

The Child and Adolescent Health group has:

- Implemented the first UK intervention effectiveness testing of Triple P for Baby, as part of the Greater Glasgow and Clyde NHS Board's roll out of population level parent support programs. This challenging RCT was delivered during a period of significant change in local and national provision of support for parents (McPherson, McAloney-Kocaman, Wiseman).
- Explored barriers and facilitators to engagement with mental health services in The Supporting Mental Health Services for Young People (SMYLE) study. Run within NHS Greater Glasgow and Clyde, outcomes will include recommendations to underpin future service delivery (McPherson, Faeth, McAloney-Kocaman, Schroeter).

The Ageing Well group has:

- Pelvic health research by the Ageing Well group included four large scale NIHR funded multicentre trials and a systematic review of the effectiveness of interventions for bladder, bowel and pelvic floor dysfunction (Booth, McClurg, Hagen).
- Specifically, research on prolapse included the first multicentre effectiveness trials of pelvic floor muscle training for this common female condition, resulting in publications in the Lancet [Hagen x 2] and evidence informing international guidelines and practice. It also included a comprehensive NIHR-funded implementation study moving the trial evidence into the NHS and contributing to policy change, and development and validation of the first brief symptom score for prolapse which has had high uptake in the UK and globally. (ICS4 in Section 4.2.2)
- The group's falls prevention research programme has demonstrated a halving of fall rates, improved physical activity and function, reduced fear of falls, improved quality of life and high return on investment from widespread implementation and adoption of the Falls Management Exercise (FaME) programme, across the UK (Skelton). (see ICS5 in Section 4.2.2)
- The group also carried out the first MRC-funded device-based objective measurement of sedentary behaviour in community dwelling older adults involving 700 older adults, resulting in 14 publications, and a dissemination event at Scottish Parliament.

1.3.2 Long-term conditions

The Musculoskeletal Health group has:

- Completed the KNEEMO Initial Training Network, which was a uniquely successful integration of epidemiological, biomechanical and medical imaging research into knee osteoarthritis by a consortium of European universities and companies. It delivered 11 PhD completions, to date 41 peer-reviewed publications, and was featured on the EC website as a success story (i.e. flagship project). GCU and KNEEMO PhD alumnus Mannisi founded a company for personalized orthotics provision, Medere, building on his KNEEMO work, which has gained a number of awards for most promising medical start-up in Italy as well as being shortlisted by the British Council for the Study UK Alumni Awards 2020-21 (network leads: Steultjens, Woodburn).
- Developed the first general patient-reported outcome measure for orthopedic foot and ankle surgery in four languages using a unique integration of diverse methods of outcome development research. It has since been validated in two more languages with additional language validations ongoing, and has been rolled out widely by the European Foot and Ankle Society (Steultjens).
- Delivered the first geospatial mapping analysis of diabetic foot complications (ulceration, amputation and death), establishing for the first time that adverse outcomes of diabetic foot disease are closely associated with being exposed to social deprivation and poverty rather than disease-related factors. This work was awarded multiple best presentation awards at international conferences (Hurst, Barn, Woodburn).
- Initiated large-scale RCTs on the effectiveness of orthopedic insoles (FOCOS) and gait rehabilitation (GREAT) in inflammatory arthritis. Feasibility of the interventions was established and (cost-)effectiveness trials are ongoing (Hendry, Barn, Steultjens, Woodburn).

The Living with Stroke and other neurological conditions group has:

- Established the Collaboration of Aphasia Trialists to support co-ordination of aphasia research across >200 multidisciplinary researchers (neurologists, linguists, psychologists, social scientists, statisticians and speech and language therapists) from 36 countries. Outputs include establishing consensus on a core outcome set, terminology for aphasia, an aphasia extension to the TiDieR checklist, individual participant data network meta-analysis, adaptation and validation of aphasia assessments into >15 languages and national and international awards. (Brady) (see ICS6 in Section 4.2.2).
- Founded Giraffe Healthcare (www.giraffehealth.com), an evidence-based start-up social enterprise. Giraffe provides a platform for the delivery of online physiotherapy and podiatry exercise. It has attracted over 2,000 registered patient users and is being deployed in the UK, Australia, Saudi Arabia and New Zealand (Paul).
- Implemented HEADS: UP (Helping Ease Anxiety and Depression after Stroke), evidence-based co-development and feasibility testing of the first co-created psychological self-management intervention, tailored specifically for people affected by stroke (Lawrence).
- Played a key role in the completion of a multi-centre RCT on robot-assisted training for the upper limb rehabilitation after stroke (RATULS). Involving a total of 770 participants with stroke, this is the largest study of its kind published to date. The findings, published in the Lancet, demonstrated that the enhanced upper limb physiotherapy programme,

designed by van Wijck, resulted in potentially important improvements in upper limb impairment, performance in activities of daily living, and mobility (ICS2 in Section 4.2.2).

The Vision Science group has:

- Developed computerised tests for examining a variety of visual functions including D Charts for measuring metamorphopsia and the Caledonian Face Test for examining facial discrimination. Both tests monitor visual change in patients with chronic conditions such as age-related macular degeneration (Logan, Loffer).
- Investigated the causes, diagnosis, and treatment of a pathology that could impair the function of the tear film, the cornea and the conjunctiva. Ongoing projects include clinical trials of new treatment modalities for dry eye, the utility of new diagnostic tests for dry eye disease, the analysis of tear fluid inflammatory proteins (with particular interest in diabetes) and the role of demodex mites in ocular pathology (Hagan, Martin).
- Been the first in Scotland to use functional near infrared spectroscopy (fNIRS) to image the visual system across the adult lifespan. They are also the first in Scotland to use fNIRS in conjunction with retinal imaging (OCTA) as applications to assess the effects of diabetes and glaucoma on eye and brain in small patient cohorts.

The Biological Mechanisms of Diabetes and other long-term conditions group has:

- Played a key role in the completion of XENOSLET (<https://xenoslet.eu>) a collaboration between academics and SMEs to pave the way for the pilot clinical delivery of porcine islets to treat diabetes. The project has delivered to date 36 peer reviewed publications (Crossan, Scobie).
- Been part of the only treatment centre in Scotland for patients suffering from pulmonary hypertension. The Scottish Vascular Pulmonary Unit (<http://spvu.co.uk>) translational arm involves novel pre-clinical studies contributing vital pre-clinical data which has then gone into clinical trials.
- Overseen the GCU Tissue biobank for normal and diabetic skin (Graham, Martin and Wright) and Microscopy facility (Martin, McQuaide) for extended use by both academics and industry with support from Scottish Universities Life Sciences Alliance (SULSA). This arose from a GCU supported project (Martin, Wright) which led to funding by the Dr Hadwen Trust/Animal Free Research, 'Improving access to human material for diabetes research: developing the GCU research tissue bank for diabetic and non-diabetic skin' (Graham, Wright) and has led to several recent PhD awards from the British Skin foundation and the Psoriasis Association and subsequent collaboration and investment from the NHS and a SME (Martin).
- Also been engaged in a One Health approach with industry via Innovate UK to address key diagnostic, therapeutic and preventative treatments for current SARS-CoV2 infections and the socio-economic impact of animal diseases (Crossan, Scobie).

1.4 Interdisciplinary Approach

There is considerable collaboration between the research groups, particularly on research grants and PhD studentships, where the combined expertise of different groups is utilised to gain different perspectives on a particular health issue. ReaCH has brought together the different strands of the GCU UoA3 research effort in new ways.

Striking examples of close collaborations include: the SHBBV and substance use in the current submission; 62.6% of our submitted outputs represent interdisciplinary research; research groups working together on infectious disease among intravenous drug users (including the £2.8M EPITOPE NIHR programme grant); the Ageing Well, Living with Stroke and Musculoskeletal Health research groups working jointly on physical activity and fatigue in chronic neurological or musculoskeletal conditions; the Safeguarding Health through Infection Prevention and Biomedical Sciences groups working on microbiological aspects of infection prevention; the Living with Stroke and Vision Science groups collaborating on vision defects post-stroke; and the collaboration between the Vision Science and Biomedical Sciences groups investigating biomedical pathways of vision defects.

1.5 Facilitating Impact

Through the work of the two impact officers, we have improved our pre- and post-award activities to ensure our research is impactful in the wider society. In essence, in the REF reporting period, societal impact has become embedded in the research development process from inception. Building upon previous achievements, and developed in collaboration with our research community, the core objectives of the ReaCH Impact Strategy are:

- To empower our research staff to undertake interdisciplinary research with meaningful impact on social, economic and health outcomes in local, national, and international publics/communities.
- To encourage researchers to engage with planning pathways to impact as early as possible in the research process.
- To provide opportunities for SHLS researchers from PhD student to Professoriate level to gain the appropriate knowledge, skills and resources to plan and evidence research impact through carefully planned knowledge exchange and patient-public involvement programmes.
- To develop research support infrastructure and target resources to strengthen existing mechanisms to promote stakeholder engagement, as well as develop systems and processes to gather robust evidence of impact.

The research impact officers have developed a programme of impact training and support, including workshops facilitated by Prof. Mark Reed (Fast Track Impact Ltd), for all SHLS staff. The three full-day workshops were delivered between 2017 and 2019. The aim of the first workshop, held on the 19th January 2017, was to provide an in-depth overview of the impact agenda, deepen researchers' understanding of impact and to provide useful tools and resources to identify stakeholders and plan for impact from research. Two further meetings were held on the 31st January 2018 and the 23rd May 2019 to provide research group leads with an opportunity to showcase their current research impact, discuss their future impact goals and receive verbal and written feedback from Mark Reed to allow these to be developed into potential impact case studies. These presentations also provided a further training opportunity for ECRs to consolidate their knowledge of research impact.

Impact plans have become an embedded feature of Stage 1 grant applications through the Peer Review College starting in 2016. This was further developed in 2019 to include an opportunity to allow researchers to request personalised support from the research impact officer to develop pathways to impact statements or embed impact plans within grant applications.

The SHLS research impact officer has provided tailored planning and support to research groups to conduct external stakeholder engagement events, such as:

- Life After Stroke knowledge exchange event led by Prof Marian Brady and Dr Christine Hazelton in May 2017, which was attended by stroke survivors and their family members (36%), health and social care professionals (38%) and charity workers/volunteers (11%). For the first time, the focus of this event was on visual problems following stroke, an under-researched area that receives attention now from both the Stroke and Vision Science research groups at GCU.
- The Impact of Minimum Unit Pricing stakeholder group was launched to assist in developing and creating impact from this research programme (Elliott/Emslie). Carefully planned knowledge exchange meetings were designed to provide a platform to the constituencies most likely to be affected by this research programme. Stakeholders were able to give their opinions in a safe environment to evaluate the barriers/enablers for impact and which policies, practices and behaviours were most likely to be changed as a result of GCU research.
- ReaCH researchers worked with the Data Lab and local communities to characterise the impact of regeneration along the Forth & Clyde Canal in North Glasgow – one of Europe's most deprived areas, highlighting the significant physical and mental wellbeing benefits that can be achieved from investing in regenerating urban waterways globally.

The research impact officers offer research groups further support, evaluating their research impact. Groups such as Ageing Well and Stroke have developed ethically approved follow-up surveys to measure the impact of key research outcomes within communities of key stakeholders globally. Support is also available for analysing data and developing the reports to be published externally.

1.6 Research Integrity

In addition to the impact officers, investments were also made in additional admin posts, including a Senior Clinical Research Governance Manager responsible for developing Standard Operating Procedures, ensuring relevant research governance related training, and ongoing monitoring and audit of all research involving human participants. This addition to our ReaCH research admin team has led to clear improvements in and streamlining of the internal GCU pre- and post-award processes. Pre-award, the peer-review process for all proposals pre-submission to funders now encompasses mandatory risk assessment and mitigation, data management and GDPR compliance. The Peer Review College (PRC), led by Steultjens, provides the governance structure for all pre-award activity. Post-award, ethical review and approval processes (both through the NHS IRAS system and internal to GCU) have been strengthened, as well as financial management, annual reporting and general audit via the School Research Committee and the ReaCH Management Group.

1.7 Open research environment

Patient and Public Involvement (PPI) has become a cornerstone of ReaCH. Through its regular PPI activity, ReaCH has markedly improved pre-award stakeholder involvement. Led by academic PPI Lead Hendry, a group of 16 academics, representing all ReaCH research groups, are currently responsible for the PPI programme, supported by two additional research administrative posts. Pre-award PPI to inform grant proposals is funded from a dedicated ReaCH budget. The PPI group runs seminars, training sessions and surgeries at the unit, research group and individual level, and provides assistance with the writing of PPI and impact sections for grant proposals. In addition to researcher-led PPI (where PPI activity is planned based on live funding calls or internally developed research hypotheses), we are currently

developing a structure to improve stakeholder-led PPI. This will centre around the SafePod data science infrastructure that will be available at GCU from Q3 2021, which has an explicit aim to provide answers to data-scientific questions raised by members of the public (see section 1.8 below).

1.8 Future strategic aims

Following this REF2021 submission, ReaCH will enter a new phase, aligning with the GCU Research Strategy 2030, launched in February 2021, which identifies five strategic objectives:

1. Devise and carry out cutting-edge, interdisciplinary research, addressing the SDGs via our three societal challenges of Healthy Lives, Inclusive Societies and Sustainable Environments.
2. Capture and promote evidence of research impact with our stakeholders in public and private sectors and in civil society.
3. Extend our research capacity and capability, striving for the highest standards of excellence.
4. Contribute to the continued development of academic culture and sense of community within the University through Group, Centre and cross-campus working on research-with-purpose.
5. Strengthen our research-teaching nexus.

The following sections illustrate how we plan to align ReaCH activity with these future strategic aims.

The immediate post REF period will offer a period for reflection, both on past achievements and the challenges ahead, particularly in the post-Covid-19 recovery period. To support this reflection and subsequent forward planning, we have already initiated actions to strengthen the role of the Research Group Leads within ReaCH and provided support for more structured planning at Research Group level. Our overarching strategic aim is to promote collegiate engagement and collaboration in addressing all aspects of the GCU 2030 Research Strategy and thereby the ReaCH objectives. This focus on strategic planning at research group level will strengthen our research leadership and enable a more cohesive approach to demonstrating progress in core strategic objectives.

The GCU 2030 Research Strategy focusses on conducting cutting-edge research which addresses societal priorities, thereby increasing income from large grants, and further expansion of interdisciplinary collaboration between research groups and units across the University (objective 1). This strategy is also informed by the Muscatelli Report, which was commissioned by the Scottish Government to describe the economic impact of the Scottish higher education institutions, and to identify the way forward to maximize this contribution (published late 2019). In particular, the Muscatelli Report recommends closer collaboration between Scottish universities and maximizing international collaborations, which is a key strategic aim for both ReaCH and wider REF UoA3 activity at GCU. Each ReaCH Research Group has been asked to identify existing internal, national and international collaborations and propose steps for expanding these, with more established groups sharing experiences and strategies with those at an earlier stage of expansion. Recent actions in the international arena include targeting the Global Challenges Research Fund to further our contribution to the United Nations Sustainable Development Goals. To this aim, collaborations are currently being developed with various partners world-wide. First projects have been initiated with the Infection Control Africa Network, the University of Sao Paulo in Brazil, various partners in the Pacific Islands and the University of Johannesburg in South Africa.

Existing initiatives to strengthen research impact i.e. the appointment of Impact and Knowledge Transfer Officers and the collaborative development of a ReaCH Impact Strategy, will be further embedded within each ReaCH group's strategic plans. In particular, by integrating Patient & Public Involvement in research and Knowledge Exchange with other stakeholders, each research group will develop an action plan to ensure impact development activities are embedded in all our work, from planning grants to generating evidence via longer term follow up, thereby addressing the GCU Strategy (objective 2). The University plans to invest in dedicated new spaces to promote our overarching strategic vision of being a world leader in social innovation, providing ReaCH teams (and other GCU Research Centre colleagues) with state-of-the-art facilities to engage with local communities and other stakeholders such as policy makers, practitioners and industry partners to co-create and promote the impact of our work.

In the last REF period, actions to build capacity (objective 3) have focussed on providing fully funded PhD studentships and appointing REG funded post-doctoral positions. We aim to review our existing research group composition to determine where future investment in staff resource might be most beneficial in achieving our goals. In addition, ReaCH will be expanding specific areas of activity. Particularly aligned with objectives 1 and 3 of the GCU 2030 research strategy, we will enhance our data science capability and capacity to expand our current portfolio of work utilising and integrating large data sets for social innovation and health care, collaborating with other disciplines internally and externally. To this aim, we have already secured funding for hosting one of the ESRC Data SafePod Network sites. This network of physical spaces dedicated to accessing large data sets from, among others, NHS and Office of National Statistics, will be established in 2021 across a number of UK universities. The GCU SafePod will be one of only two in Scotland. Access to this network will enable us to routinely include big data analyses in our research programmes, and open up data science for AHP research, where it is currently only utilised infrequently world-wide. GCU has invested in a number of fully-funded PhD studentships to kick-start our work within the SafePod network, to commence in Q3 2021. This will also form part of a closer collaboration with GCU's SMART Technology Centre to develop a new initiative, 'data science for the Common Good'.

By facilitating regular in-depth discussions and sharing good practice via the ReaCH Management Group, involving all research group leads, we anticipate that the University and ReaCH strategic aims will increasingly be 'owned' by research groups, who will experience greater empowerment in determining the steps by which capacity, capability, and impact will grow within their individual groups (objectives 3 & 4 above). Acknowledging that our groups are currently at different places in a trajectory towards achieving Strategy 2030 objectives, each ReaCH group has been challenged to develop and share preliminary one year (due to 2020 covid impact) and subsequently five year strategic plans, outlining their current position and steps to be taken towards achieving the comprehensive objectives within our refreshed Strategy.

Regarding strategic objective 5, we will further develop our teaching-research nexus, through which we inspire and impact students by having research-oriented and research-led teaching. All of our research active staff are embedded in learning and teaching activities within educational programmes in their respective professional discipline programmes, however, much of this activity is currently 'hidden'. In future, we aim to surface and celebrate the impact of our researchers in the student experience by showcasing exemplars of innovative or inspirational practice, which reflects a strengthening of the 'research-teaching nexus' in our School. We will do this by ensuring the wide range of activities are identified in research group's strategic plans, collating and reporting these in annual ReaCH Reports, our website and in student recruitment materials.

2. People

2.1 Staffing strategy

Since REF2014, GCU has implemented a career-progression pathway specifically for research-active staff, spanning the journey from early-career researcher (ECR, with 21 staff members

returned within the Unit) to full professor, enabled via our annual Performance Development and Appraisal Review process. In addition, professorial banding has been brought in to reflect the continuing development and progression of the most senior staff. Progression criteria for research-active staff reflect the importance to GCU of research excellence combined with clearly defined societal impact. The staffing strategy, articulated in the annual School Operational Plan is aimed at ensuring all research groups within the two research programmes are adequately staffed at all seniority levels. Specifically, the following actions have been taken:

- Annual academic promotion rounds incorporated clearly defined progression criteria based on research excellence.
- Using Research Excellence Grant (REG) funds awarded following REF2014, 48 fully-funded doctoral studentships were supported, with equality of allocation across the research groups and programmes. Staff members have benefitted from these posts to progress their research careers to the point of inclusion in this REF submission (e.g. Hurst, Innes).
- Cross-group and cross-programme collaboration and mentorship were fostered, ensuring interdisciplinarity, exchange of perspectives and optimisation of use of available skills and expertise.
- Enable outward and inward secondments (i.e. from GCU to external stakeholder organisations, e.g. the NHS; and vice versa). Within the reporting period seven external secondees became research-active within GCU's UoA3 research effort, and 31 members of staff from GCU's allied health research pool with significant responsibility for research were formally active within stakeholder organisations, ranging from clinical-academic posts in the NHS (Estcourt, Woodburn, Reilly, Booth, Nelson) to Board of Trustees membership for major UK-wide health charities (Steultjens).
- In the GCU workload allocation model, explicit guidance has been included on defining time allocated to research and knowledge exchange, and setting performance and development goals for staff members related to these activities. The workload allocation and associated goals were used as the primary source of information for establishing significant responsibility for research and inclusion in this REF submission.

2.2 Staff development

Through the Performance and Development Annual Review (PDAR), progress of staff at all stages of their research career is monitored and facilitated. Research active staff have their PDAR meetings with both their Heads of Department and Research Group Lead to ensure their research activity is successfully embedded within their academic role and adequately supported. The PDAR system forms the backbone of the ongoing commitment to staff development. In the PDAR meetings, workload allocation for research and knowledge exchange is set and reviewed, as described above. Work allocation for research is guided by a framework for staff members and their line managers to define time allocated to research and knowledge exchange activities, whilst also proposing a career path for those staff members who wish to develop their research activities. The guidance includes clear regulations to ensure equality of opportunity, diversity in staff progressing their careers, and merit-based assessment and progression criteria.

Key initiatives to develop staff include:

- The ReaCH seminar series, which is led on a rotational basis by the different research groups. The seminars feature presentations and workshops by ReaCH staff as well as local, national and international experts. These focus on topical depth, disseminating new evidence in fields of research relevant to the ReaCH effort, and generating new research questions and grant ideas.

- Special Interest Groups (SIGs) bring together academics from across the research programmes and groups. SIGs explore key methodologies. Currently active SIGs include those focusing on PPI; systematic review and meta-analysis; quantitative analysis; methods of qualitative research; and advancing gender equality (see section 2.4).
- Workshops and short courses for the development of generic and transferable skills are provided on a monthly basis at the university and unit levels, including project management, academic leadership, financial management, time management, digital literacy, and influencing policy making.
- As described above, across the assessment period, workshops on research impact have been held regularly with external experts, with a view to developing impact skills in our staff as well as guiding the impact case studies for REF2021. Impact is a standing agenda item at the School Research Committee and ReaCH Management group.
- In addition, personal development as guided through the PDAR process is fostered through secondments, sabbaticals, and an annual personal development budget enabling staff to attend external courses and conferences and make academic visits.
- Furthermore, GCU has accommodated staff being involved in external roles, including government panels or as a committee member, charity Trustee, NHS consultant, or visiting academic to other universities.
- Visiting professorships are awarded strategically to improve our understanding of and connection to areas of research that are critical to our research excellence. In total, during the REF assessment period, there were six active visiting professorships. In addition, we hosted 24 non-GCU employees as visiting fellows and five inward secondees as researchers, primarily from the NHS.
- The Peer Review College has all research-active staff as members and reviews all grant proposals prior to external submission. All staff involved as reviewers and applicants thus gain valuable skills and knowledge, while the quality of grant proposals is improved through this enhanced pre-award governance process, as evidenced by the increase in grant funding success in this REF assessment period.
- The SHLS Crucible was developed by Emslie as 3-day intensive leadership programme for SHLS ECRs. It was first held in April 2018 and repeated in May 2019. The programme includes experts in communications and public affairs, community and public engagement, research impact and knowledge exchange culminating in a meeting with MSPs at the Scottish Parliament to raise awareness of GCU health research. In total, 21 ECRs have been trained: n=11 in 2018 and n=10 in 2019. The Crucible will run for the third time in 2021 with a new cohort of ECRs.

2.3 PGR student support

All Doctoral projects (GCU and self-funded opportunities) are advertised externally on [FindaPhD](#). Recruitment starts via an on-line application system, where confidential information regarding protected characteristics is also gathered and reported at an Institutional level, followed by review by our Postgraduate Research Tutors before interview by a potential supervisory team and final decision made on an offer. All decision cards are reviewed by the PGRT and approved by the Associate Dean research to ensure appropriate supervisory teams and resources for the project are in place before an offer is made.

We require all PGR students to submit regular supervisory meeting records to our PGR Co-ordinator (monthly for FT, bi-monthly for PT), as well as an annual progress report. Mechanisms to monitor submission of these reports include review by the Senior PGRT and Associate Dean

Research, with early follow up to offer support where any potential issues with progression are emerging.

Annual PGR student surveys indicate a high level of satisfaction with the PGR offer. In the 2019 Postgraduate Research Student Experience Survey (PRES) conducted at GCU, PhD students within SHLS (which includes all ReaCH PGR students) reported an overall satisfaction rate of 83% compared with a cross sector average of 81% (Advanced HE PRES 2019). PhD students rated the performance in several areas to be above sector averages. These included supervision (SHLS 89%, sector 86%), research skills (SHLS 88%, sector 86%) and resources (SHLS 89%, sector 81%). These responses reflect the outstanding and supportive environment experienced by PhD students including dedicated supervision teams and extensive development opportunities offered by the GCU's Graduate School.

To sustain our record of providing an outstanding PGR experience, the following support systems are in place:

- All new PGR supervisors are required to undertake training for this role, while there are mandatory refresher courses for experienced supervisors.
- Mentorship is available for all supervisors on a voluntary basis, mandatory for new Directors of Studies, allowing supervisors to safely discuss and improve their role performance.
- An academic member of staff (Stansfield) has been appointed Senior PGR Tutor and acts as lead for the entire PGR cohort, including decision-making on funding for conference visits and courses, acting as a primary contact point for issues concerning the PGR constituency, and developing new initiatives to further improve the quality of our PGR offering, thus enhancing the PGR student experience. He is supported by five other PGR Tutors, all experienced members of academic staff (Lorimer, Hendry, Martin, Hagan, Finlayson).
- Regular seminars, workshops and lectures are organised at the research group, programme and unit levels. In the reporting period these included:
 - Monthly journal clubs at research group level, with one PGR student taking the lead each time featuring key literature relevant to their own project,
 - Monthly writing retreats organised at the programme and unit levels, allowing groups of PGR students to progress their thesis and journal paper writing together.
 - Methodology and statistics lectures, systematic reviewing skills training and qualitative methodology training are provided to PGR students working with these methods by leading topical experts among the ReaCH academic staff to provide additional depth where needed to the set courses provided by the GCU Graduate School that are part of every PGR student's training programme.
 - Academic presentation and TEDtalk workshops, as well as PPI and dissemination, outreach and impact training were also provided at the group and unit level as well as GCU-wide by the Graduate School.
 - Introduction to peer review seminars for PGR students and ECRs were hosted on the GCU campus and delivered by the charity Sense About Science twice in the current REF assessment period. These seminars were open to students and ECR staff from other universities, and attended by students and staff from Strathclyde, Glasgow and West of Scotland universities in addition to GCU staff and students.

- On the annual GCU Research Day, a dedicated PGR research poster and presentation session is included.
- The 3-minute thesis competition (3MT) runs annually, with the GCU final held on the annual Research Day. The GCU 3MT winner takes part in the national 3MT competition.

2.4 Equality and diversity

GCU holds an Athena SWAN Bronze Award and has a strong commitment to equality and diversity in the workplace. In the 2020 Times Higher Education University Impact Rankings, GCU was listed as 12th in the world for promoting SDG 5, Gender equality, and 14th in the world for SDG 10, reducing inequality.

The GCU commitment to equality and diversity is evidenced by a high proportion of female professors among academic staff, and a 0% median and 2.6% mean gender pay gap. In this UoA3 submission, 60.6% of staff and 63.6% of full professors are female. The Advancing Gender Equality group (previously known as the Women in STEM SIG) acts as a forum for female staff and an advocate for further enhancing gender equity within the unit.

To help those with carer and/or parental responsibilities, all staff meetings are scheduled within the core hours of 10AM to 4PM. In addition, the SHLS and ReaCH premises are accessible to wheelchair users and other mobility-limited people as well as the visually impaired.

7.1% of staff submitted to UoA3 in REF2021 are from BAME backgrounds. This return is in line with the overall percentage of BAME staff in the university (7.3%). In light of the challenges surrounding ethnicity of both students and academics across the University (14% of undergraduate students are BAME), a series of recommendations has been made, recognising that institutional racism is a structural and not an individual issue and that tackling racism and racial inequalities should form a core part of the University's Common Good mission: that each service and function across GCU makes a commitment to tackle racism and racial inequalities; review recruitment processes and target the recruitment of BAME people; take active steps to diversify senior management and key committees; commit to providing race and racism focused training and development on a range of topics for all staff and leaders that is positioned as a compulsory and essential requirement for all to carry out their job and support GCU's goals and values; develop and communicate appropriate, rigorous, and safe mechanisms for the University to receive reports of racism in confidence; develop and communicate appropriate mechanisms to enable the University's services and functions to receive feedback.

SHLS also reflects the University's commitment to support staff and learners with disabilities, identifying barriers and biases in programme material/activities and aligning with the Strategy for Learning principle of inclusive, accessible learning and supports the University's compliance with the Equality Act (EQA) 2010. This includes an Inclusive and Accessible Learning and Teaching Checklist which provides guidance for academic colleagues who are involved in the design or delivery of modules and programmes.

3. Income, infrastructure and facilities

3.1 Income

In the reporting period, average annual grant income within the unit rose to £3.68M, an increase of 64% compared to the REF2014 reporting period. By proportion, grant income from research councils (MRC, ESRC, EPSRC), government bodies (NIHR), European Commission and Richmond Group charities increased significantly, accounting for 57% of all income compared to 42% for the REF2014 submission. Notable grants within UoA3 with grant income exceeding £1M in the reporting period included:

- The successful work on Hepatitis C led by Hutchinson was underpinned by grants from Public Health Scotland and NIHR totaling £7.5M.
- The KNEEMO Initial Training Network (ITN) was funded by the European Commission's FP7 programme (EUR 4.2M) with GCU as the lead beneficiary (Steultjens, Woodburn). It was given the highest possible rating upon conclusion in 2018, and listed on the European Commission's website as a success story.
- A second ITN, CASCADE, was awarded in 2020 (EUR 4M) to a consortium led by Chastin and Dall to advance methods of co-creation and participatory research in public health and health care through EU Horizon 2020 funding.
- The Gait Rehabilitation in Early Arthritis (GREAT) trial was awarded by NIHR to a GCU-led (Steultjens, Hendry, Woodburn) consortium in 2017 for five years (£1.8M), and is currently in progress having successfully completed the feasibility trial stage.
- Developing methods to Evidence 'Social enterprise as a public health intervention' was funded by MRC (£1.9m) and delivered as a collaboration between UoAs 3 (Baker, Mason), 17 and 20.
- CommonHealth Assets: a realist evaluation of how community led organisations impact on health, wellbeing and health inequalities – a further £1.5m was awarded NIHR in 2020 (Baker, Mason).
- Public Health Scotland awarded funding of £1.26m, 2015-20 for an applied infection prevention workstream as part of the Scottish Health Care Associated Infection Prevention Institute (SHAIPi) Consortium (Reilly, Currie, Price, Lang).
- Economic Impact of Nosocomial Infection Project (ECONI) 2015-2020. This study is investigating the cost and impact of Healthcare Associated Infection to patients, the health service and the wider community. Funded by NHS Health Protection Scotland and led by GCU (funding to GCU of £1.3M).
- Analytical research to inform on the effectiveness of services to prevent, diagnose and treat blood borne viruses in Scotland (2020-2024). (Funded by Health Protection Scotland, 2020-2024, £1.1M).
- Evaluating the population impact of hepatitis C direct acting antiviral treatment as prevention for people who inject drugs (EPIToPe). (Funded by NIHR, 2018-23, £2.8M).
- 2016-2021 LUSTRUM: limiting undetected STIs & HIV to reduce morbidity. NIHR PGfAR Programme Grant, RP-PG-0614-20009 (£2.5M) (Estcourt, Frankis).
- Following completion of LUSTRUM, a new £2.5M NIHR PGfAR was awarded and initiated in November 2020. Building on the success of the proof-of-concept eSexual Health Clinic (led by Estcourt), which contains a world-first online automated prescribing consultation for the treatment of chlamydia, the successful proposal for the new grant centres around eSexual Health.
- Evaluating the impact of alcohol availability on population health (NIHR £1.1M) (Emslie).
- Booth leads on the £1.2M NIHR-funded pelvic floor training for preventing urinary incontinence. In total, the pelvic health research in this unit is associated with £6.5M of grant funding.

- Also in biological sciences, through the Scottish Vascular Pulmonary Unit, £1.5M in funding was attracted from charities and industry.

In addition, GCU UoA3 staff were co-investigators in a large number of high-value and high-prestige grants led by other institutions, and led on/collaborated in a multitude of grants with income <£1M. In total, there were 308 live research grants over the current REF assessment period led or collaborated in by ReaCH, Yunus Centre and NMAHP-RU staff for work fitting the REF UoA3 remit. The average value of all grants won was £84k and total value of £25.8m.

Prestigious grants with key involvement from GCU researchers included:

- In biological sciences, the XENOSLET programme, which investigated the feasibility of clinically delivering porcine islets as a human diabetes treatment was delivered on a EUR 6.4M EU FP7 grant (Scobie, Crossan).
- A multi-centre RCT on robot-assisted training for the upper limb rehabilitation after stroke (RATULS, £3m) (van Wijck).

Notable grants held at GCU with funding <£1M included:

- FOCOS, investigating foot orthotics in rheumatoid arthritis (Scholl Foundation, £300k) (Hendry, Steultjens, Woodburn).
- An £812k MRC-funded investigation into sedentary behaviour in older adults (Chastin, Dall).
- HEADS: UP, £430k from Chief Scientist Office and Stroke Association – Helping Ease Anxiety and Depression After Stroke (Lawrence).
- £400k British Heart Foundation fellowship with additional industry funding to support work on vascular and pulmonary remodeling in pulmonary hypertension (Welsh).
- Two studies sponsored by the Food Standards Agency (total £400k) on foodborne viral disease, which aim to develop a thermal model for viral risks associated with cooking food (Scobie).
- Additional funding on research into consequences of alcohol availability (£768k) from ESRC (Emslie).

3.2 Infrastructure and facilities

As described in section 1, the GCU UoA3 research hub is ReaCH, with significant contributions by NMAHP-RU and the Yunus Centre. ReaCH is located on the GCU Glasgow City campus, with most facilities co-located within the SHLS Govan Mbeki building. Total inward investment by GCU into these facilities exceeded £1.5M over the REF assessment period. These facilities include:

- Co-located offices and meeting room, used for group, programme and unit meetings as well as seminars, workshops and PPI activities.
- Human Performance Laboratory. This is used extensively in research by the musculoskeletal health, stroke, diabetes and healthy ageing research groups. The HPL offers integrated measurement of gait biomechanics, kinetics and kinematics, energy expenditure, muscle activity, proprioception and plantar pressure. The HPL is now a

designated clinical facility for NHS Lanarkshire, used in the assessment of orthopaedic patients.

- Medical imaging facilities on campus include ultrasonography, x-ray imaging, and functional neuro-imaging using near-infrared spectroscopy (fNIRS), while we have collaborated with BMI Ross Hall Hospital for access to Magnetic Resonance Imaging during the REF assessment period.
- For our work in biomedical sciences, we are fully equipped with wet and dry labs, including upgraded laser scanning microscopy systems that were installed within this REF assessment period.
- For vision science, we are equipped with ocular surface labs which include a controlled environment chamber.
- As described under section 1.8 on future strategic aims, from Q3 2021 we will have one of two Scotland-located pods in the SafePod network, as part of a major strategic drive to enhance our data science capacity and capability.
- The psychophysical research lab is equipped in such a way that it enables precise control of visual stimuli, and is used for psychology, vision science and interdisciplinary research.
- In addition to these ReaCH-based facilities, NMAHP-RU and the Yunus Centre provide office and meeting space to the UoA3 research effort.
- A suite of dedicated PGR offices enabling co-location and peer engagement.

Wider GCU infrastructure and facilities provide critical support for improving the quality and impact of GCU's UoA3 research. These include:

- The Research and Innovation Office (RIO), which is responsible for promoting research opportunities, award management, and all contractual arrangements between GCU and external research funders. Pre-award, RIO provides budget calculations for all research grant proposals, including consultancies and contract research. It then guides principal investigators through the award process, including consortium agreements where applicable, and ensuring compliance with financial reporting regulations post-award, and, where pertinent, supports project management activities.
- GCU UHatch supports students and staff to progress business ideas into a viable company and specialises in support for social enterprise. During this REF assessment period, it has facilitated the start-up of social enterprises and businesses within the broad area of UoA3, including Giraffe Healthcare. GCU UHatch works in close collaboration with the First Port, Community Enterprise in Scotland, Scottish Institute for Enterprise, and Santander Universities.
- The GCU Library has provided support to a large portfolio of literature reviews – in particular in designing search strategies, facilitating data access and identifying sources of information to optimize data capture for specific topics. Of the 219 outputs (plus five in reserve) included in this GCU UoA3 REF submission, 30 (14%) are systematic reviews and/or meta-analyses, indicating this type of research is a well-established mode of knowledge generation in this UoA at GCU.

4. Collaboration and contribution to the research base, economy and society4.1 Research collaborations, networks and partnerships4.1.1 Strategic partnerships

There are two large strategic partnerships that underpin a substantial proportion of work in GCU's UoA3 submission: those with Health Protection Scotland (HPS), now named Public Health Scotland (PHS) and with NHS Lanarkshire.

Public Health Scotland (PHS) is part of the NHS National Services Scotland and plans and delivers effective and specialist national services which co-ordinate, strengthen and support activities aimed at protecting the people of Scotland from infectious and environmental hazards. GCU's collaboration with PHS is primarily within the public health research programme, and more specifically the research undertaken by the sexual health and bloodborne viruses research group and the safeguarding health through infection control research group. As noted above in section 3.1, within the REF assessment period significant funding from HPS has enabled us to carry out large research projects and provide societal impact through our close links with PHS.

The formal collaboration with NHS Lanarkshire was established late in the REF assessment period and will come to fruition in the near future. As part of the collaboration, the three main hospitals within the health board were given university hospital status (Monklands, Wishaw, Hairmyres), conferring benefits in terms of staff training, clinical-academic placements and research collaborations. Already we are seeing the benefits of this with large projects, such as the NIHR-funded GREAT trial (see section 3.1) being hosted by NHS Lanarkshire. In addition, as mentioned in section 3.2, the human performance laboratory on the GCU Glasgow city centre campus is now an accredited NHS Lanarkshire clinical facility. It provides biomechanical and physical performance testing for orthopaedic and diabetic patients, which is used to inform clinical decision making and the surgical and non-surgical management of patients.

4.1.2 International collaborations and networks

The portfolio of international collaborations is rich and diverse, stretching beyond the production of joint articles. In addition to ReaCH's close collaboration with prominent international organisations such as the European Centre for Disease Control and the World Health Organisation, a number of large-scale networks have been led by UoA3 research groups through European and other international funding. These include:

- The FP7 ITN KNEEMO project, led by GCU, provided a step-change in the understanding and non-pharmacological management of the Osteoarthritis through early identification and personalized interventions. It was delivered through a partnership of universities and companies: VU Medisch Centrum, Westfälische Wilhelms-Universität Münster, Syddansk Universitet, Aalborg University, Paracelsus Medical University Salzburg, Xsens Technologies B.V., and Peacocks Medical Group. It also included a number of Associate Partners including patient groups, universities and knowledge transfer specialists, all of whom contributed to the development of the research fellows through specialised training and hosting secondments: University of Melbourne, European Society of Movement Analysis for Adults and Children, Institute of Knowledge Transfer and the University of Leeds.
- The GCU-led COST Action, Collaboration of Aphasia Trialists (CATs), aimed to develop and support an international network of collaborators with an interest in aphasia rehabilitation research to facilitate the conduct of high quality, coordinated aphasia research activities. Working Groups within the action included researchers from National and Kapodistrian University of Athens, Erasmus MC, University of Southern Denmark, St.Petersburg State University, the University of Queensland, University of the

Witwatersrand South Africa, University of Canterbury New Zealand, National Research University Higher School of Economics and St.Petersburg State Pediatric Medical University, Russia. By the end of the project, it had involved 179 multidisciplinary aphasia researchers from 26 countries.

- Reflecting the University's outward-facing Common Good Mission, ReaCH has been particularly active in forging partnerships with ODA countries, especially through GCRF:
 - Building capacity for healthcare associated infection and antimicrobial resistance surveillance in Cameroon with the Banson Baptist Hospital.
 - Development and Evaluation of Telerehabilitation in Ghana with Brooks Rehabilitation Centre, Crown Medical Centre, and Nadkoff Physiotherapy and Wellness Centre in Ghana.
 - Collaboration with University of Johannesburg (UJ) Podiatry Department in order to strengthen research and development capacity through postgraduate research studentship training and to develop disciplinary and interdisciplinary research collaborations.
 - A study of the prevalence of, and services for, pelvic organ prolapse in Pacific Island nations and developmental work to support further collaboration with National University of Samoa, Pacific Society for Reproductive Health, MIOT Pacific Hospital, Colonial War Memorial Hospital, Fiji National University, and Vaiola Hospital in Nuku'alofa.
 - An exploration of the implementation of Infection Prevention and Control (IPC) Guidance at Health Facility Level in Uganda with the Infection Control Africa Network (ICAN).
 - Visual Sciences Screening Protocols in Ghana with Kwame Nkrumah University of Science and Technology; Vision Aid Overseas.

4.2 Contributions to the research base, economy and society

4.2.1 Research base

On traditional measures of academic impact, this submission includes a strong portfolio of outputs. Our work has been published in the top academic journals in the world, as well as the top-ranked journals for specific fields of medicine and health science. Various outputs are among the most frequently cited for the journals they were published in. According to a 2014 analysis by Nature, 100 citations puts an output into the 1.8% most-cited outputs in science. Our UoA3 submission includes 9 papers with >100 citations, as well as a further 3 papers with >90 citations as of December 2020 (Source: Incites). The average number of citations of all outputs in the submission is currently 23, which puts the average output in this submission into the top quintile of all peer-reviewed scientific outputs.

This submission, in the outputs section, includes a number of large reports for NIHR-HTA or other NIHR/MRC programmes. Of these reports, journal outputs were also available describing parts of the work contained in the reports, often in top journals such as The Lancet. In these cases, however, we decided to include the full reports as they more accurately describe the fullness of the world-leading research contained within them.

4.2.2 Impact case studies

This submission includes seven impact case studies relating to our research, showcasing the impact of our research beyond academia. These are:

ICS1: Major reduction in hepatitis C infected people presenting with serious liver disease following an evidenced-based public health strategy in Scotland

Professors Hutchinson and Goldberg established a research programme on the hepatitis C virus (HCV) that has shaped Scotland's public health response and led to major health benefits. Their epidemiological studies and modeling – addressing the knowledge gap in how to scale-up therapy for greatest health gain – underpinned the Scottish Government's HCV strategy and setting of targets on treatment. HCV treatment targets have been met, and lead to reductions in liver-related failure (67%), cancer (69%) and death (49%). Over 300 cases of liver failure have been averted in the first four years of the national HCV strategy, translating to £30M saving to the NHS.

ICS2: A reduction in healthcare-associated infections through influencing policy and healthcare practice

The group's research has changed Scottish healthcare-associated infection screening policy, leading to a year-on-year decrease of 17.1% in the prevalence of infections, following an increased uptake of the policy from 75% to 87%. A pioneering programme of studies has improved the validity of the European Centre for Disease Prevention and Control's healthcare-associated infection survey methodology, resulting in an additional 450,000 (10%) infections being estimated across 28 countries. Globally our research has formed the basis of World Health Organisation's guidance that has led to an increase in the proportion of countries with a national infection prevention programme, from 41% to 63%.

ICS3: Reducing HIV infections in key vulnerable populations by informing Scottish, UK and wider European prevention policy and practice

Research at GCU has been instrumental in reducing transmission of HIV by directly shaping policy in Scotland and the Republic of Ireland, and by changing models of care in Scotland, and by influencing European HIV Pre-exposure prophylaxis (PrEP) guidance. In Scotland, PrEP has reduced by two thirds the overall risk of acquiring HIV in men who have sex with men, and recently acquired infections have decreased by 40% since PrEP was introduced in 2017. People who inject drugs in western Scotland are among the first world-wide to benefit from a PrEP service to prevent HIV transmission.

ICS4: Improving the management of pelvic organ prolapse through effective treatment and monitoring: international impact on policy, healthcare professionals and outcomes for women

Hagen and team demonstrated that pelvic floor muscle training (PFMT) is effective and cost-effective for prevention and treatment of prolapse, and reduces uptake of subsequent treatment, leading to recommendation of PFMT by NICE, and globally by the International Consultation on Incontinence, who recommend it as first-line treatment. Their discovery of new models of effectively delivering PFMT has provided ways to treat more women than previously possible. Their development, evaluation and translation of the Pelvic Organ Prolapse Symptom Score has resulted in improvements in prolapse care and outcomes in the UK, Australia, Ireland, USA, Ethiopia, India, Brazil, Nepal and Turkey.

ICS5: Reduced falls and improved physical, mental and social health of older adults - Implementation and adoption of the Falls Management Exercise (FaME) programme

Falls in older adults represent an escalating public health concern. The Falls Management Exercise (FaME) programme, in sedentary older people, reduces the rate of falls and increases physical activity close to recommended levels for health. This led to adoption of FaME by multiple Public Health bodies and widespread implementation across the UK and Norway. FaME halves the number of falls, improves quality of life, physical activity and physical function, reduces fear of falls and produces a return on investment of between £2.89-£50.59 for every £1

invested. Community led FaME group programmes reach over 10,700 older people per week in the UK.

ICS6: Improving services for people with aphasia after stroke through enhancing evidence-based policy and service standards

Professor Brady's GCU research was instrumental in changing aphasia rehabilitation policy and standards for stroke survivors with problems speaking, understanding, reading and writing language across 23 countries including Australia, Brazil, Canada, Germany, Morocco, Norway, South Korea and the UK. National stroke service-delivery guidance was informed by GCU-led Cochrane systematic reviews, providing ground-breaking, conclusive evidence that speech and language therapy (SLT) benefits aphasia recovery, informing specialist aphasia service development within the emergent Croatian, Iranian, Lithuanian and Turkish SLT profession. GCU-led data-syntheses established that high intensity, acute-stroke SLT, where tolerated, was beneficial and mobilising technology and trained non-professionals effectively augments rehabilitation services.

ICS7: Enhanced support for stroke rehabilitation and long-term recovery through improved training and educational resources

Globally, support for recovery after stroke is substandard. Insights from our original research on priority areas for improving post-stroke recovery have been instrumental in the development of novel educational resources on vision rehabilitation and secondary stroke prevention (including physical activity and sedentary behaviour) for service users and providers in stroke rehabilitation and recovery support. These new resources, used by over 20,000 service users in 134 countries and completed by over 3,100 service providers within the UK and abroad (including Ireland, Australia and New Zealand), have raised educational standards and enabled the development of innovative, evidence-based stroke rehabilitation and recovery support services.

4.2.3 Wider impact on economy and society

Beyond the impact case studies highlighted above, our research has made substantial contributions, not least during the Covid-19 pandemic. Prof. Reilly is part of the Scottish Government Covid-19 Advisory Group, contributing directly to the policies implemented by the Scottish Government related to the pandemic – including designing the characteristics of the lockdown and the Scottish route map through and out of the crisis, as published by the Scottish Government on 21 May, 2020. The work of the Advisory Group is closely informed by the epidemiological modelling provided by the GCU SHBBV research group (Hutchinson, Goldberg, McAuley) which redirected much of its activity towards Covid-19 research during this time. At the present time, the full impact of the Covid-19 pandemic to Scottish society is not yet known, and the effectiveness of policies will have to be evaluated. What is certain, is that the impact was profound, and that GCU research and members of staff were at the heart of the management of this crisis.

Beyond Covid-19, our work informed health policy in Scotland, the UK and internationally. The work on stroke rehabilitation (Brady), as described in ICS5, has been used to set care guidelines in Australia, New Zealand, Germany, the Netherlands, Finland, Italy, Norway, Sweden, South Korea, the USA, Ireland and the UK. General physical activity guidelines in Canada were updated based on research by Chastin, Skelton and Dall. Price was invited to contribute to the US Presidential committee on healthcare-associated infection control. Reilly led work to validate infection surveillance approaches across Europe. Systematic reviews led by Price and Reilly underpin the WHO 2019 Guidelines for Core Components of National Infection Prevention.

The Scottish government policy for minimum alcohol pricing was informed by work by Emslie and colleagues. This work has had a direct influence on alcohol policy e.g., Public Health Scotland stated that findings and recommendations from our research had a direct influence on ensuring that they will assess the impact of Minimum Unit Pricing on alcohol-attributable hospital admissions and deaths by sex (Elliott, Emslie, Dimova, Whiteford). Elements of this work were

embodied in the launch of a social media campaign (2018) to draw attention to how alcohol is cynically marketed to women by equating it with female empowerment (#dontpinkmydrink). The campaign has received international media attention, influenced and informed the work of UK and international alcohol charities (e.g., Alcohol Focus Scotland and FARE) and stimulated policy debate when a motion supporting the campaign was raised by Monica Lennon MSP in the Scottish Parliament (Emslie).

Other work from the Substance Use research group informed proposals by the Glasgow City Health and Care Partnership to open the UK's first drug consumption room. Evidence presented to the Scottish Affairs Committee received extensive international media coverage and was quoted directly by the First Minister in the Scottish Parliament (McAuley).

Not all impact was achieved through informing policy change. The geospatial analysis of risk of diabetic foot complications (Hurst, Barn, Woodburn) directly led to redesign of diabetes services and reallocation of resources by NHS Greater Glasgow and Clyde.

Giraffe Healthcare, the social enterprise start-up from GCU (Paul) now offers online delivery of physiotherapy and podiatry to over 2,000 registered patients, including in remote areas of Saudi Arabia, Australia and New Zealand. GCU UoA3 research also informed the education of health care professionals elsewhere. Through the Grameen Caledonian College of Nursing in Dhaka, Bangladesh, nursing students were educated based on our research, in particular around infection prevention (Price). GCU was also the lead partner in a number of European-funded capacity building projects to help embed research and innovation best practice in Vietnam and South Africa (Woodburn).

4.2.4 Individual researcher contributions to society and indicators of esteem

Roles as (associate) editor and editorial board member for scientific and professional journals have been held by Baker, Emslie, Skelton, van Wijck, Price, Woodburn, Steultjens, Hendry, Scobie, Logan, Nelson, Chastin, Hutchinson, Goldberg and Booth. In addition, Steultjens, Hutchinson, Emslie, Woodburn and Goldberg were members of review panels at UKRI (predominantly MRC/NIHR level). Various members work to progress the quality of medical and allied health care through their roles in the Royal College of Surgeons and Physicians Glasgow and/or the Royal College of Physicians Edinburgh (Skelton, Woodburn, Barn). Reilly is a Fellow of the Faculty of Public Health (FFPH) and the Royal Society of Biology (FRSB). Steultjens is a member of the Board of Trustees at Versus Arthritis, previously known as Arthritis Research UK, one of the Richmond Group of medical research charities. Contributions to Cross-Party Groups (CPGs) at the Scottish Parliament, as well as Scottish Government committees and functions, were made by Emslie, McAuley, Estcourt, Dall, McParland, Steultjens, Skelton, Chastin, Hendry, Woodburn, Price, Reilly, Hutchinson and Booth.

4.3 Conclusion

In conclusion, this UoA3 REF environment statement for GCU has described a much larger research effort than in previous REF cycles. This was evidenced by increased numbers of staff with significant responsibility for research (up 94% by headcount, 102% by FTE), average grant income (up 64%) and Research doctoral degrees awarded (up 74%). This was the result of targeted development of two cohesive yet wide-ranging research programmes in public health and long-term conditions, underpinned by an inclusive ethos, clear staff development activity and facilitation of interdisciplinary work. As a unit, the newly launched ReaCH is a strong collaborator in local, national and international partnerships and networks. Building on these strong foundations, we aim to undertake a major effort in data science as well as expanding our work in the communities we serve to further increase our societal impact.