REF2021

Institution: University of Manchester

Unit of Assessment: 2 - Public Health, Health Services and Primary Care

1. Unit context and structure, research and impact strategy

1.1 Summary of the Unit of Assessment (89 persons; 85.6 FTE)

Since REF2014, we have doubled the size of our UoA2 return to provide expertise aligned with our translational pathway from discovery to implementation. We have trebled our research income to £156.5m, built a vibrant PhD student cohort, and developed early-career researchers, representing 25% of our return. We have returned 214 outputs with a median of 55 citations per output and 28% having >100 citations (median field-weighted citation index 4.98 - Scopus).

UoA2 research contributes to realising the World Health Organization (WHO) goal of narrowing health inequalities globally. Our research helps prevent and treat physical and mental disorders across the life-course. We improve understanding of these disorders, identify solutions and implement enhanced practice and policy to benefit our Greater Manchester communities and achieve national and international impact.

We deliver research in three themes: Epidemiology and Public Health; Health Services and Policy; and Methodology and Data Analytics. We develop and apply advanced analytics to explore the causes of disease, its distribution in populations, and the effectiveness of treatments. Our impacts include improved cancer prevention and care, better targeted treatment for patients with respiratory diseases and enhanced safety of new medicines for inflammatory disorders (sections 1.2 and 1.3).

Our cross-Faculty Research Domains in Applied Health and Digital Health have driven interdisciplinary working and wider collaborations (section 1.4). Our translational pipeline from discovery to implementation is supported by infrastructure, including: NIHR Biomedical Research Centre, School for Primary Care Research, Patient Safety Translational Research Centre, Applied Research Collaboration, and two Policy Research Units (section 3.2). We are fully integrated into the regional research and innovation ecosystem through one of only six Academic Health Science Centres and the unique Health Innovation Manchester, which hosts the regional Academic Health Science Network. We maximise impact through long-term engagement with policymakers, close collaboration with patients and the public, and evidence-based implementation science (section 1.6). The impact of our research has improved suicide risk management, ensured NHS resources are distributed according to need, and identified the best models of care for frail populations.

1.2 Headline achievements

Below we summarise how we delivered on our strategic aims from REF2014.

1.2.1 Improved understanding of factors underpinning disease causation, progression, and treatment response

Immune-mediated inflammatory diseases have a major impact. New targeted biologic therapies are effective but expensive, and their safety was unknown. We established biologics registers in arthritis, psoriasis and lupus. Our pharmacoepidemiological analyses of these registers has reassured clinicians and patients that these novel therapies will not elevate cancer risk following treatment for rheumatoid arthritis (**Dixon, Hyrich, Lunt, Symmons** Ann Rheum Dis 2015) or serious infection risk during treatment for psoriasis (**Lunt** J Invest Dermatol 2018).

We examined regional differences in deprivation, disease, and mortality in England. We compared patterns of disease to primary care funding, showing how the North East and North West have the highest levels of morbidity but only average funding (**Kontopantelis** BMC

Medicine 2018, **Kontopantelis, Webb** Lancet Public Health 2018). We showed that the health gap between the North and South costs the economy £31bn per year (Health for Wealth report), an inequality widened by COVID-19 (NHSA report). Our work with European and Global indicators is influencing how health data are captured and utilised (**Verma** Health 2020 indicators), with all WHO Europe member states now reporting on these indicators.

Inequality is a determinant of poor outcomes globally. In South Africa, one of the most unequal societies, we investigated the impact of cash transfers on mental health (**Sutton** Soc Sci Med 2020). In Denmark, one of the least unequal nations, our analyses demonstrated how growing up in a relatively deprived family still increases incidence of self-harm (**Kapur, Webb** Lancet Public Health 2018) and mental illness (**Webb** JAMA Psychiatry 2019).

We developed novel allocation formulae so policymakers could distribute resources according to need. We created formulae for the £100bn NHS England allocates annually for hospital, mental health, sexual health and drug misuse services. Our work will reduce the health gap between affluent and deprived areas, as independent research on our previous formulae has shown.

1.2.2 Innovation in policy, organisation and delivery

We host the National Confidential Inquiry into Suicide & Safety in Mental Health, collating data on all UK suicides since 1996. Our recommendations are cited in policy guidance, improving safety in mental health settings (**Kapur** Lancet Psychiatry 2016a, 2016b), and contributing to a reduction of 200-300 suicides annually.

Government policy has prioritised 7-day hospital services because of concerns about increased risk of death amongst weekend admissions. We showed that this 'weekend effect' may be a statistical artefact (**Anselmi, Meacock, Sutton** J Health Serv Res Policy 2017*)*, and questioned whether the required annual investment of £1-1.5bn is cost-effective (**Meacock, Sutton**, Health Econ 2015). Our work reduced Government focus on this policy, freeing resources for more effective investment.

1.2.3 Better tailoring of health interventions to needs, including precision medicine

COPD is a leading cause of death globally. We developed more effective inhaled therapies, targeting treatment using blood eosinophils to reduce exacerbations and pneumonia risk (**Vestbo** Am J Respir Crit Care Med 2015). We demonstrated effectiveness in 'real world' populations that are socially deprived and have prevalent cardiovascular disease (**Vestbo** N Engl J Med 2016, **Vestbo** Lancet 2016 & 2017). Our findings changed clinical guidelines and transformed COPD care worldwide (ICS 'Definitive multinational efficacy trials and pioneering 'real-world' evidence').

Depression is a health priority globally and collaborative care is one of the best evidence-based treatments. As well as demonstrating the effectiveness of collaborative care in depression and multimorbidity (**Bower, Waheed** BMJ 2015), our international collaborative analyses supported better targeting of treatment (**Bower, Kontopantelis, Panagioti** JAMA Psychiatry 2016).

1.3 Strategic Framework

We work to a new Faculty-wide **strategic framework,** with 3 Grand Challenges:

- Discovering novel biological, psychological, and social mechanisms

- Developing new approaches to prevention and early detection of disease

- Developing next generation person-centred therapies, interventions, and care pathways

Our expertise in examining social determinants ensured that the Grand Challenges focussed on social mechanisms, and on care pathways through our expertise in health services research. Although our research has international impact, we work in the context of our region's health problems. Deprived communities face barriers to accessing services along with poorer health outcomes. Our Salford Lung Study (**Vestbo** N Engl J Med 2016) received international recognition by conducting trials with these populations, generating investment and improving care in a deprived borough.

Greater Manchester (GM) is leading new ways of improving population health, with a devolved budget of £6bn for 2.8 million citizens managed by the GM Health and Social Care Partnership (GMHSCP). We support GMHSCP by assessing patterns of disease and helping them to deploy effective ways of improving health (**Peek, Sutton, Turner**). We partner with the Chan School of Public Health (Harvard) to generate global lessons from this policy experiment.

UoA2 is structured around three themes:

(1) Epidemiology and Public Health (34.5 FTE)

(2) Health Services and Policy (25.3 FTE)

(3) Methodology and Data Analytics (25.8 FTE)

Reflecting our multidisciplinary approach, our return comprises 89 (85.6 FTE) staff from 9 of the 18 divisions within the Faculty of Biology, Medicine and Health (FBMH). FBMH was created in 2016 through an ambitious merger of the Faculty of Life Sciences and the Faculty of Medical and Human Sciences. To facilitate effective working after the 2016 merger, we created cross-Faculty Research Domains to grow interdisciplinary research and build capacity (section 1.4).
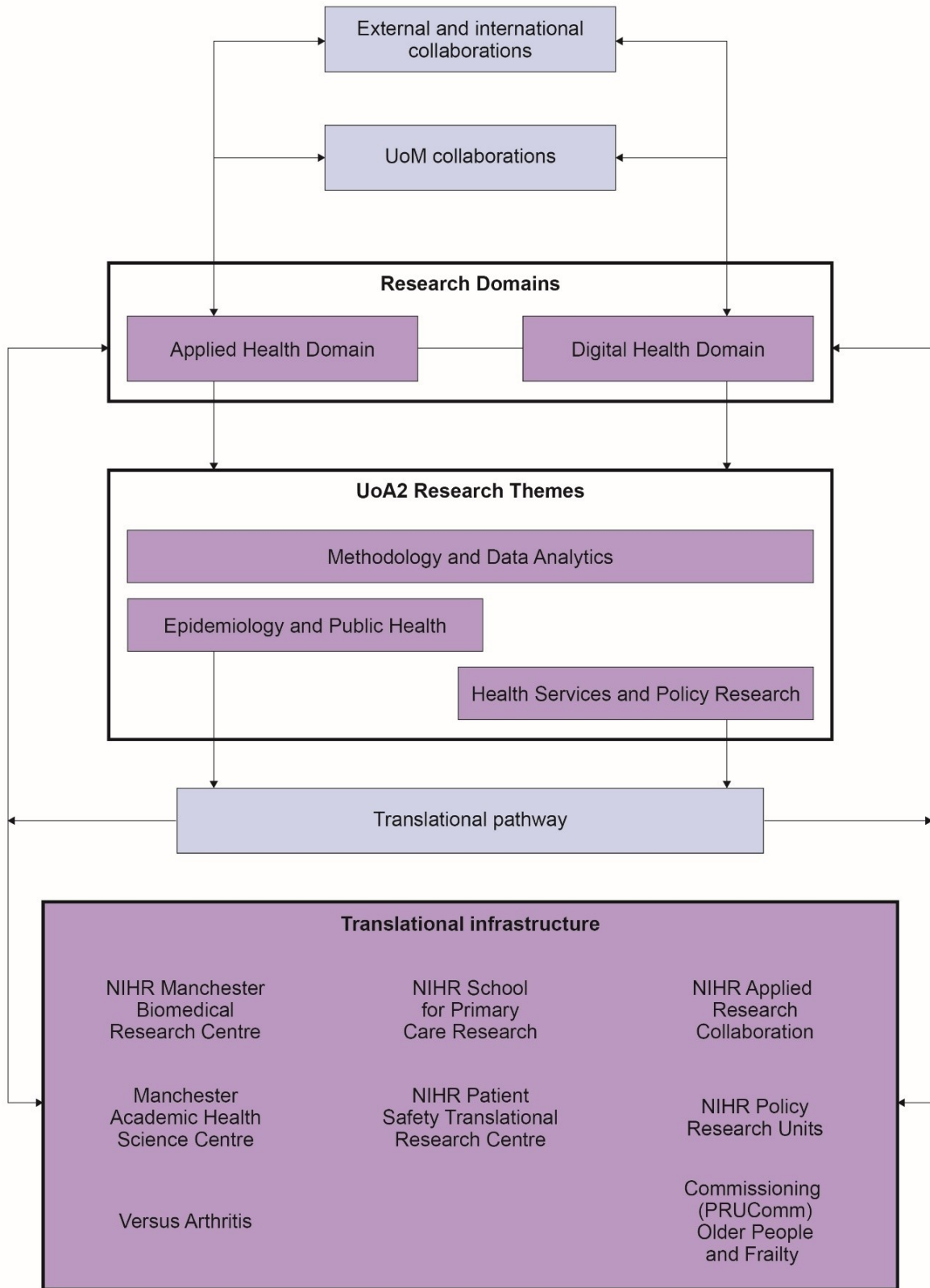
Interdisciplinary research is critical for our UoA, and staff are located to maximise their contribution. Some are located in methodological hubs (informatics, economics and biostatistics) to develop specialist expertise and provide career support. Others are located in clinical areas (e.g., musculoskeletal diseases) or in topic-driven centres (e.g., primary care, occupational health) to promote interdisciplinary work.

To maximise impact, we have secured significant infrastructure funding to support a translational pathway from discovery through to large scale implementation (see Figure 1 and section 3).

This includes:

- NIHR Biomedical Research Centre (BRC, £28.50m)

- Manchester Academic Health Science Centre (MAHSC)

- Centre for Epidemiology Versus Arthritis (£6.09m)

- NIHR Patient Safety Translational Research Centre (PSTRC, £12.58m)

- NIHR School for Primary Care Research (SPCR, £2.46m)

- NIHR Applied Research Collaborative (ARC-GM, £8.99m)

- NIHR Policy Research Units in Older People and Frailty (PRU-OPF, £2.49m) and Commissioning (PRUComm, £2.45m)

Figure 1: Relationships between our themes, domains, and the translational infrastructure

External and international collaborations

UoM collaborations

Research Domains

Applied Health Domain

Digital Health Domain

UoA2 Research Themes

Methodology and Data Analytics

Epidemiology and Public Health

Health Services and Policy Research

Translational pathway

Translational infrastructure

NIHR Manchester Biomedical Research Centre

NIHR School for Primary Care Research

NIHR Applied Research Collaboration

Manchester Academic Health Science Centre

NIHR Patient Safety Translational Research Centre

NIHR Policy Research Units

Versus Arthritis

Commissioning (PRUComm) Older People and Frailty

1.3.1 Theme 1 - Epidemiology and Public Health

We discover the distribution and determinants of health and disease, to better target interventions to improve health and reduce inequalities. Core areas include:

- genomic and precision medicine (**Lamb, Lophatananon, Muir, Ollier, Payne, Guo**)
- musculoskeletal disease (**Dixon, Felson, Hyrich, Lunt, McBeth, O'Neill, Symmons**)
- cancer (**Evans, McCabe, Renehan**)
- addiction (**Jones, Millar**)
- respiratory diseases (**Simpson, Vestbo**)
- circulatory diseases (**Kontopantelis**, **Rutter, Vail**)
- diabetes (**Kontopantelis, Rutter**)
- dermatology (**Lunt, Vail**)
- mental health and suicide (**Kapur, Webb**)
- occupational, environmental and public health (**van Tongeren, Verstappen, Verma**).

To discover new approaches to multimorbidity we host a cross-Faculty multimorbidity network (**Peek**). We also tackle health inequalities including upstream interventions for disease prevention (**Kontopantelis, Munford, Verma, Webb**). Theme 1 researchers have extensive links into clinical medicine (UoA1).

Evans established the frequency of Lynch syndrome in endometrial cancer (**Evans** PLoS Med 2020), generating a NICE recommendation for universal testing - 220 women with endometrial cancer are now identified annually with Lynch syndrome (plus three family members), empowering 1,000 people annually to reduce their risk. Our IBIS-I & II studies (**Evans** Lancet Oncol 2015, Lancet 2020) informed NICE guidelines on tamoxifen, raloxifene and anastrozole chemoprevention. We deliver real-time breast cancer risk stratification (BC-Predict) and there are advanced plans for roll out in the GM breast screening programme to enable the offer of anastrozole chemoprevention in 20% of the population. We conduct work on obesity and cancer in the UoM Cancer Research Beacon (**Renehan** Lancet Oncology 2015), highlighting the need for gender and age-specific strategies to prevent obesity-related cancers.

To tackle health inequalities, we partner with the Northern Health Science Alliance (NHSA), linking universities, NHS Trusts and Academic Health Science Networks (AHSNs) covering 16m people. We have demonstrated how health inequalities drive economic inequalities - people are 39% more likely to lose jobs following ill-health in the North. We engaged with policymakers to drive action (**Munford**)**,** including six Parliamentary questions (2019), three citations in House of Commons debates (2019), press releases by GM Mayor and Newcastle City Council Leader (2018), and evidence to the Treasury Select Committee (2020) enquiry into 'The Economic Impact of Coronavirus'. The NHSA and other partners launched the Northern Universities' Public Health Alliance (NUPHA) to tackle regional health inequalities (**Verma**).

1.3.2 Theme 2 - Health Services and Policy

Theme 1 informs thinking in Theme 2 about service delivery and policy change to improve outcomes and reduce inequalities. We work closely with colleagues in the Manchester Centre for Health Psychology (French, Armitage UoA4), psychiatry (Shaw, Appleby, Abel, Husain UoA4), economics (Andrews, Banks UoA16), and nursing (Bee, Lovell UoA3). Collaborations with Humanities (Walshe, McBride, Rubery, UoA17) are in section 1.5. Core areas include:

- Workforce (**Checkland, Spooner**)
- Quality and safety (**Campbell, Elliott, Esmail**)
- Person-centred care (**Blakeman**, **Bower, Sanders)**
- Service organisation and funding (**Birch, Meacock, Sutton**)
- Social care (**Morciano**)

We disseminated evidence on addiction-related deaths (**Jones, Millar** Addiction 2016) to the House of Commons Health and Social Care Select Committee Review of Drug Policy (2019). We stimulated US debates in the *New York Times* and *Washington Post (*ICS 'Stimulating debate, changing practice and influencing policy in tackling drug-related deaths').

Using our translational infrastructure (Figure 1), our PSTRC created a dashboard of indicators of medication safety and delivered this in front-line care (**Brown, Peek** PLoS Med 2020). We reduced hazardous prescribing by 28% in Salford (population 235,595), before wider implementation through ARC-GM across the conurbation's population of 2.8m people. To improve safety in mental health, we created a social enterprise to deliver suicide prevention training worldwide (ICS 'Risk assessment and suicide prevention').

Academy of Medical Sciences highlighted the challenge of multimorbidity, and we delivered trials of new care pathways (**Blakemore, Hann, Reeves, Waheed** BMJ 2015, **Bower** Lancet 2018).

We pioneered digital tools to allow patients to track symptoms and share decision-making in mental health and rheumatology (**Dixon, McBeth, Ainsworth**) in interdisciplinary work with Computer Science (**Sanders**). We developed *Cloudy with a Chance of Pain*, engaging thousands in 'citizen science' to track weather and pain, attracting international media attention (**Dixon, Ainsworth** Nature Digital Medicine 2019).

1.3.3 Theme 3 - Methodology and Data Analytics

We developed advanced research methods to understand the determinants of disease and discern the impacts of treatment, service and policy interventions.

Core areas include:

- Analysis of large databases (section 3) (**Gittins, Kontopantelis, Lunt, van Staa, Webb**)
- Advanced modelling for causal inference (**Berzuini, Guo, Sperrin, Sutton, Turner**)
- Health technology assessment to support innovation (**Payne, Elliott**)
- Research methods using smartphone and personal sensors (**Ainsworth, Dixon**)
- Informatics infrastructure for data analysis at scale (**Ainsworth, Peek, van Staa**).

Valid causal inference is critical to our Grand Challenges. Our biostatisticians (**Berzuini, Guo, Vail**) have developed new Bayesian approaches to Mendelian randomisation analysis which outperform standard methods (**Berzuini, Guo** Biostatistics 2020), as well as advances in causal mediation analysis (**Dunn, Emsley** HTA 2015).

Our economists have developed new methods for policy evaluation and natural experiments such as synthetic controls (**Turner, Sutton** Health Econ 2016) and generalised synthetic controls (**Sutton** Health Services Research 2020), to support evaluations of national policies:

- Advancing Quality incentive scheme for hospitals (**Turner, Sutton** N Engl J Med 2014)
- Extended access GP services (**Whittaker** PLoS Med 2016)
- NHS Vanguard integrated care covering 5 million (**Morciano, Sutton** Health Policy 2020)

This expertise is also critical to our support for local decision-makers tackling regional health priorities. Our close working with the GMHSCP (**Sutton, Turner, Coleman**) has supported the evaluation of devolution, including the GM Population Health Outcomes Framework and the Benefits Realisation Dashboard to track regional performance, and exploration of variation in outcomes across different localities (**Wilson)**.

1.3.4 Future research strategy

Our strategy is to transition to a genuine 'Learning Health System' (section 4.3.4), transforming care regionally and acting as a beacon for developments nationally and internationally. Our Learning Health System will make more rapid links between the insights garnered from live data to achieve real-world translational impact thereby improving population health. This will be achieved by continuous analysis of data (via routine care, alongside bespoke research data) to monitor outcomes, identify new care developments, and implement evidence-based changes. To deliver such a system requires access to rich data, an ability to implement radical changes at scale, and innovative methods to evaluate impact rapidly and rigorously.

Throughout this statement, we have described the building blocks for such a system:

- Improving timely access to routinely collected data, through our Connected Health Cities and Local Health and Care Record Exemplars (section 4.3.4)

- Enhancing routinely collected data with additional data from patients (see section 1.3.2)

- Working with communities to build trust in data gathering (section 4.2.2.3)

- Developing a translational implementation pipeline (Figure 1)

- Developing new approaches for:

  o testing causal relationships through rigorous non-randomised methods for large-scale evaluations (section 1.3.3)

  o conducting trials in patient populations with greater health needs (ICS 'Definitive multinational efficacy trials and pioneering 'real-world' evidence')

Our strategy is to integrate these building blocks into a coherent Learning Health System. We will enrich the system with data oriented to the needs of our patients, including quality of life. This will be achieved with better digital tools and engagement with the public.

Working with the University's Global Inequalities Beacon, our work will continue to focus on communities with the greatest health and care needs locally, nationally and internationally. We will undertake research with under-researched populations, engaging them effectively in the entire research and impact process and developing interventions to improve outcomes for these disadvantaged groups. Our focus will also be on problems where the starkest inequalities exist; for instance, clusters of multiple long-term conditions.

We will continue to innovate in service delivery and health policy to identify new approaches to prevention and treatment. Working closely with regional and national decision makers, and with patients and communities, our teams will co-produce innovations meeting their needs. We will utilise our expertise in service redesign and focus on high priority areas such as the use of digital technology to better co-ordinate care, and the development of integrated care for frail patients.

A key focus will be developing and testing innovations that contribute to long-term sustainability. Some innovations will focus on the demand-side, ensuring that populations are supported to reduce their reliance on services. Other innovations will be supply-side solutions, increasing efficiency through new configurations of workforce, finance and organisations to offer populations the right care in the right place at the right time.

Working with Health Innovation Manchester, we will create a clear translational pipeline from innovation to realisation of benefit, improving population health and reducing inequality. A key goal is to integrate evaluation and implementation through enhancements to research design, to reduce delays between the development of innovations and delivery to patients.

1.4 Research Domains

FBMH created eight research domains, to co-ordinate research and impact and encourage collaborations. Two domains are of particular relevance to UoA2: Applied Health and Digital Health. The principal successes that they achieved are described below.

1.4.1 Applied Health Domain

This domain (lead **Sutton**) integrated work in applied health research across the University, linking epidemiology and relevant clinical disciplines with health services research and health informatics.

The Domain has driven the following successes:

- Developing capacity in implementation science, enabling renewal of the NIHR ARC-GM (£5.9m) and appointment of a senior lecturer in implementation science (**Wilson**) in 2019.

- Supporting collaborations within the University, including the Manchester Interdisciplinary Centre for Research on Ageing (MICRA, **O'Neill**), as well as the Cathie Marsh, Cancer, and Work and Equalities Institutes. The collaboration with MICRA supported award of the NIHR OPF-PRU led by Todd (UoA3) (**Bower, O'Neill,** section 3)

- Supporting the interdisciplinary centres Institute of Health Policy and Organisation (**Checkland**), Thomas Ashton Institute (**van Tongeren**) and Manchester Environmental Research Institute (**van Tongeren,** section 1.5).

1.4.2 Digital Health domain

This domain (lead **Peek**) co-ordinates our capabilities in engineering and methods for digital health (through the School of Computer Science and Engineering UoA11, and membership of the Alan Turing Institute), and strengths in digital health research through the MRC Health eResearch Centre (HeRC, **Ainsworth**), PSTRC (**Campbell, Kapur, Peek, Sanders, Webb**), BRC (**Evans, Peek, Vestbo**) and ARC-GM (**Peek**).

The Domain has driven the following successes:

- **Christabel Pankhurst Institute for Health Technology**, a £25m investment to capitalise on excellence in digital health and advanced materials, with the Faculty of Science and Engineering (section 3).

- **Health Data Research UK (HDRUK) Better Care Northern Partnership**, a substantive HDRUK site. This collaboration uses our infrastructure to generate actionable insights from data to serve the needs of 16m people (**van Staa**).

- Development of the **GM Local Health and Care Record** and GM-wide infrastructure to improve how the NHS and its partners share information securely (section 4.3.4).

Peek leads our contribution to the University Digital Futures programme, working with colleagues from Humanities and Computer Science.

1.5 Interdisciplinary Research

Tackling population health requires an interdisciplinary approach. Our research involves a wide variety of disciplines within health, including economics, informatics (see section 4) and behavioural sciences. We collaborate beyond health, including computer science (**Peek**), law (**Sanders**) and health and environmental sciences (**van Tongeren**). We feed into UoM Global

Inequalities Research Beacon (e.g., **Verma** was Director of WHO Collaborating Centre in Health Indicators). We publish in journals in 231 different subject areas (Scopus).

To facilitate an interdisciplinary approach, we created a new Institute of Health Policy and Organisation (IHPO), representing a collaboration between STEM, social sciences and humanities (REF5a section 2iii). IHPO (**Checkland, Anselmi**) brings together researchers from our Faculty and the wider University (especially Humanities) with interests in organisation and workforce (**Spooner**); governance, leadership and regulation (**Allen**); and health in a wider context (**Kontopantelis, Munford**). IHPO has facilitated collaborations with Chandola (UoA21) on North vs. South regional disparities (**Kontopantelis, Sperrin** J Epidemiol Community Health 2017) and the impact of the NHS Diabetes Prevention Programme on disadvantaged communities (**Whittaker, Cotterill** Diabetes Med 2020).

IHPO has three aims (a) developing interdisciplinary collaboration (b) capacity building (c) building a strong external identity. Since 2019, IHPO has helped capture £7.3m funding from NIHR and other funders and provides 'seed-corn' initial funding to support future bids.

Our staff contribute expertise to other interdisciplinary centres.

The Thomas Ashton Institute (TAI) is a collaboration with the Health and Safety Executive (HSE), to understand workplace exposures that lead to ill-health (**van Tongeren**). TAI has engaged with 58 companies representing 15 different sectors (including academia, construction, energy, engineering, government, transport, health and manufacturing). We deliver The Health and Occupation Research Network (THOR) on occupational disease. The Discovering Safety Programme aims to improve health and safety globally (funded by the Lloyds Register Foundation £10m) and we secured funding for Phase 2, with Phase 1 informing HSE guidance. Our 'trailblazer' Cabinet Office funded projects were considered in evidence to the Public Accounts Select Committee (2019).

Manchester Environmental Research Institute (MERI) leads work on environmental effects (especially pollution) on human health, including cognition and brain health (**van Tongeren**) with colleagues in Humanities and Engineering. Through MERI we are linked into the Manchester Urban Observatory and contribute to studies of environmental determinants (traffic pollution, indoor air, occupation) of a range of outcomes (cognition, chronic morbidity, reproductive health). We collaborate in several European projects (e.g., Exposome Project for Health and Occupational Research).

In the Manchester Urban Institute (MUI), we lead on health and wellbeing (**Verma**) with colleagues from across all three Faculties and external stakeholders.

1.6 Achieving impact

Our institutional environment statement (see REF5a section 2) outlines our focus on impact, where we were first in Europe in the 2018 *THE* University Impact Rankings.

Within UoA2, we provide support (implementation science through our PSTRC and ARC-GM) and incentives (incorporating impact into staff reviews). Dedicated Impact Ambassadors link impact to strategy, signpost opportunities, improve impact case visibility, and review impact, all overseen by the University Research Impact Group. We provide impact resources and signpost researchers to support - the Business Engagement Team, Innovation Factory, and policy@manchester connecting researchers with policymakers.

We use three mechanisms for impact.

The first is a 'pipeline' from discovery through efficacy testing to implementation (Figure 1). We have the full range of infrastructure along this pipeline to drive impact from development to implementation, such as our SMASH medication safety system (section 1.3.2).

To maximise the effectiveness of this pipeline, our ARC-GM is embedded in HInM, the local Academic Health Science Network. HInM aims to facilitate the seamless delivery of research and encourage integration of regional research and innovation systems, 'spreading innovation at pace and scale'. **Wilson** sits on HInM's Qualification Committee, which prioritises innovation activities, whilst others provide evaluation expertise (**Whittaker, Bower, Kontopantelis**).

Examples of this pipeline include:

- Our ICS 'ASPIRE™' used machine learning to detect undiagnosed fractures in patients with osteoporosis and has recently been implemented in the NHS.

The second major mechanism is through close working with decision-makers, using our advanced data analytics and routinely collected data to support decisions (section 4).

- Our ICS 'Radical reorganisation of trauma services' demonstrated how analysis of routinely collected data can support service redesign and reduce mortality.

The third mechanism is engagement with policymakers, especially via our PRUs. This depends on the development of long-term relationships to encourage open communication and debate. PRUComm (**Checkland**) organises meetings under Chatham House Rules to facilitate robust discussion with senior policymakers, whilst IHPO hosts 'away days' for senior civil servants.

- We evaluated Vanguards integrated care (£389m, covering 5m people), identifying the best models of integration (**Morciano, Checkland, Stokes, Sutton** Health Policy 2020).

1.7 Open data

In line with University strategies, we are committed to an open research environment through consistent sharing of research materials. In a joint initiative, HInM and BRC have created 'metadata' catalogues of data, to optimise access and encourage collaboration.

The GM Connected Health City (section 4) established a Trustworthy Research Environment, gaining ISO 27001 and NHS DSP Toolkit certifications. This is available for the whole institution through Restricted Data Service.

We emphasise use of data to improve health but acknowledge confidentiality issues. We encouraged debates through our research and engagement activities (**Hassan, Peek** J Med Internet Res 2018). Our Centre for Epidemiology Versus Arthritis established infrastructure for data sharing for research, consistent with consent and public expectations. These principles are implemented in innovations such as *Cloudy with a Chance of Pain*.

We utilise datasets such as the Clinical Practice Research Datalink and created a repository of reproducible code lists to support replication (**Kontopantelis, Reeves** PLoS One 2014).

1.8 Research integrity

The Faculty Research Governance Team works across UoM to support research in the NHS, acting on behalf of the University as Research Governance Sponsor to ensure that all research meets the UK Policy Framework for Health and Social Care Research.

Within the University, the Faculty team work alongside the Research Governance, Ethics and Integrity Team to advance the Research Integrity agenda and (through the UoM Code of Good Research Practice) ensure alignment with the principles outlined in the Universities UK (UUK) Concordat to Support Research Integrity.

UoA2 have introduced research integrity and GDPR training for all staff and has instituted a new ethical approval system during the REF period to support these activities.

2. People

2.1 Summary

Since REF2014 we have developed our UoA to provide expertise across the full translational pathway from discovery to implementation, and we have doubled the size of our return. We aim to recruit and nurture the best staff in disciplines relevant to our three themes, with a focus on areas of need identified by stakeholders (such as NIHR and GMHSCP), including clinical academics in primary care; social care; implementation science; and methodology (economics, statistics, informatics).

2.2 Underpinning staffing strategy and staff development

Our approach to researcher development is summarised in Figure 2.

Figure 2: Faculty support across the researcher development continuum
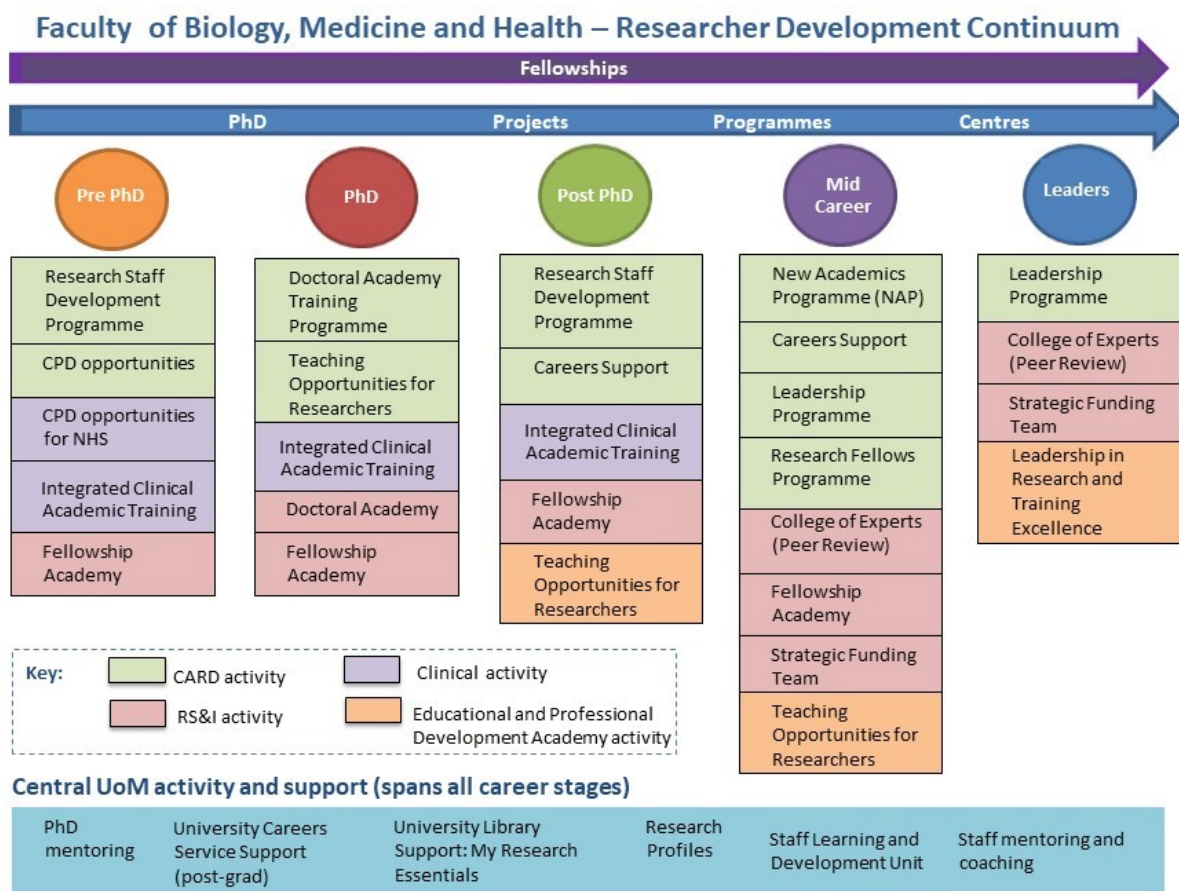
The Centre for Academic and Researcher Development (CARD) supports development of academic staff and early career researchers, while Research Business Support Services (RBSS) support research grant management.

The Faculty Researcher Development Group co-ordinates activity to align researcher development to our Faculty Strategy and ensure equity of access to staff. Faculty strategy encompasses the principles of the Researcher Development Concordat (UoM was awarded European Commission's HR Excellence in Research badge, retained since 2011). This recognises the comprehensive support through (a) Faculty researcher development teams (b) professional and support services (c) our concordat implementation plan.

The strategy incorporates:

- Assessment of staff views: through staff surveys, we showed 93% satisfaction in 2019. Data are fed back to the Research Staff Strategy Group.

- Extended contracts: we implemented a policy for researchers with greater than 4 years' service, with 3 months' salary beyond the statutory period for career development.

- Redeployment: we use redeployment to bridge funding gaps. Our Extended Access Policy (flagged in our HR Excellence in Research award renewal 2017) maintains resources for 12 months post-contract.

- Staff development: we have an explicit statement of staff expectations and an extensive induction process, providing 10 days development annually, a catalogue of >1000 training opportunities, and annual performance and development reviews.

- We run University-wide events including: Annual Research Staff conference and 'Manchester Gold' mentoring.

- Our 'Investing in Success' funding supports career development. Additionally, we provide conference and 'carer support' funds.

- We reward staff through annual promotions, ensuring parity of esteem across pathways and supporting career-breaks and part-time working. Applications are supported by promotion workshops and 'champions'.

2.2.1 Centre for Academic and Researcher Development (CARD)

25% of our return are early-career researchers (ECRs), highlighting the robust support provided by CARD (Figure 2) which includes:

- A foundation-level graduate training programme.

- The researcher development programme provides intermediate level training to maximise outputs and impact.

- A new academics and fellows programme, leading to Fellowship of the Higher Education Academy.

- The 2-year Faculty Leadership Programme to develop future leaders.

- Faculty Research Staff Representatives Forum to promote staff interests at all levels.

CARD supported 51 promotions during the REF period, with the success rate higher in 2019 (88%) than in 2015 (81%), including 16 to Chair, 10 to Reader, 18 to senior lecturers/research fellow and seven to research fellow, alongside eight senior appointments.

Below, we detail these developments and how they align to our strategy.

2.2.2 Epidemiology and Public Health

Key promotions included **Dixon** (Chair to lead the Versus Arthritis Research Centre), **Webb** (Chair; PSTRC theme lead), **Jones** (Senior Lecturer), **Lunt, Lamb** (Readers), **Verstappen** (Senior Research Fellow), **Hyrich, McBeth, Rutter, Renehan** (Chair) and **Verma** (Chair and Division lead). **van Tongeren** (Chair) and **van der Veer** (Senior Lecturer) were new appointments.

2.2.3 Health Services and Policy

Key promotions in this period included **Checkland** (Chair, lead for PRUComm), **Millar** (Chair) and **Sanders** (Chair; PSTRC theme lead). We also strengthened our mid-career researcher cohort with several promotions to Senior Research Fellow/Senior Lecturer (**Anselmi, Meacock, Coleman, Jones, Panagioti** and new appointment **Morciano).**

2.2.4 Methodology and Data Analytics

We strengthened our leadership through the appointment of **Peek** (Chair Lead for Digital Health domain), **van Staa** (Chair) and promotion of **Kontopantelis** (Chair) and **Brown** (Senior Clinical Fellow). We continued to augment health economics through the appointment of **Elliott**. Retirements in biostatistics were managed through external appointment (**Kirkham** Chair) and promotion (**Reeves, Vail** Chairs) as well as appointments (**Sutton C**) and the promotion of a cohort of senior lecturers/fellows (**Cotterill, Geifman, Guo, Hann, Sergeant, Sperrin**). Wider appointments in AI (Yau, Kaski, UoA11) are complementary.

2.5 Supporting ECRs through infrastructure

A key ambition from REF2014 was to secure longer-term infrastructure funding (section 3). As well as providing a platform for research and impact, infrastructure provides a rich environment for ECRs. SPCR funding supported capacity building in the priority area of primary care. This occurred through funded fellowships supporting rapid career development, such as **Kontopantelis**, who was supported by an SPCR fellowship before promotion to Chair in Data Sciences**.** We also used 'seed-corn' funding to support ECRs between awards to maximise success in competitive schemes, prior to baseline positions. For example, **Munford** used SPCR 'seed-corn' to apply for an MRC fellowship, before securing a permanent position. **McMillan** used SPCR project funding to support an NIHR advanced Fellowship, while **Spooner** used the same project funding to support larger grant success and a role in ARC-GM. These successes supported our continued membership of SPCR in the 2019 competition.

To address staff retention and career development, our methodology centres have implemented funding models which centralise funding across multiple grants requiring specialist expertise. This funding provides longer-term (3-5 year) contracts from a pooled resource, supporting up to six staff in each centre and enhancing progression.

2.6 Supporting interdisciplinary research

2.6.1 Institute of Health Policy and Organisation

IHPO established a Researcher Development Network to support ECRs through initiatives such as seed-corn grants, funding for international collaborations, and workshops and masterclasses. These led to seven applications, and funding with Humanities (Walshe, Rubery UoA17) led by **Spooner** (NIHR £800k) and **Allen** (NIHR £645k). The 'Pipeline' events saw academic staff (including international visitors) developing ideas with researchers into papers. PhD students and ECRs are actively involved in the workshops held at the bi-annual Organisational Behaviour in Healthcare Conference, with students awarded bursaries for the last three conferences.

2.6.2 Integrated Interdisciplinary Innovations in Healthcare Sciences Hub

We used £5.5m UoM investment over five years for this development, designed to link data sciences with public health and clinical medicine. Research-led teaching provides a platform for open access courses, teaching and resources for PhD students and ECRs. The Hub aims to create the next generation of researchers and research-trained health professionals, working alongside the Manchester Doctoral College (responsible for oversight of all doctoral training and researcher development across UoM) and Centres for Doctoral Training. Since 2018, the Hub has generated over £1m of research funding and £1m of teaching income.

2.7 Supporting clinical academics

Clinical academics are additionally supported through the Integrated Clinical Academic Training (ICAT) programme. ICAT is a partnership between UoM, Health Education North West and the NIHR Trainees Coordinating Centre. Clinical trainees have opportunities within our array of world-class research facilities from biomedical to population health.

SPCR is an exemplar for our clinical academic strategy. With research capacity in primary care being low, but a priority for funders, we invested in a range of capacity building.

- With Health Education North West, we support a programme for GP Academic Clinical Fellowships (ACFs). In addition to success with national competition posts, we established two local ACFs. Over four years, we had 11 GP ACFs.

- We have secured NIHR In-Practice Fellowships for three GPs starting an academic career.

- We moved three GPs onto PhD programmes with Wellcome, NIHR and Cancer Research UK funding.

- We supported postdoctoral development, through NIHR Clinical Lecturers and their transition to permanent academic posts: **Blakeman** (Senior Lecturer), **Brown** (Wellcome Research Fellowship), **McMillan** (NIHR Advanced Fellowship) and **Spooner** (ARC-GM).

2.8 Fellowship Academy

The Faculty Fellowship Academy helps researchers gain external fellowships, with support from initial planning to interview. Fellowship Academy Clinics and a Fellows Network supports application development, drawing on the expertise of funder panels and rigorous peer-review.

During the REF period, we have secured 16 fellowships, including NIHR In-Practice Fellowships, MRC Clinical (**Jani**) and Skills Development Fellowships (**Stokes**, **Munford**, **Anselmi**, **Hassan**), Wellcome Clinical Career Development (**Brown**) and NIHR Advanced Fellowships (**McMillan**). Additionally, Presidential Research Fellows (**Hodkinson**, **Turner**, **Wilkinson**, **Zghebi**) are a UoM scheme providing 3-year support to promising ECRs for development and external applications.

2.9 Research students

We awarded 120 PhD degrees during the REF2021 period compared to 65 during the REF2014 period. We maintained a similar ratio of PhDs awarded per FTE (1.40 versus 1.56 in REF2014) despite the substantially larger return of ECRs.

Postgraduate research funding includes MRC, NIHR, ESRC, EPSRC, Wellcome and Versus Arthritis. The President's Doctoral Scholar Award, started in 2012 via an investment of >£2.5m, supports international and Home/EU students. We awarded PhDs to home (77%), EU (10%) and overseas (13%) students.

The Manchester Doctoral College oversees all aspects of the postgraduate research student journey. Students have access to funding for conferences and society membership. A network of representatives supports peer integration and encourages dialogue between students and the Doctoral Academy Management Group. Students are allocated an academic Advisor, acting in a pastoral role, and to a designated Tutor to support progress. PRES results showed satisfaction with supervisory contact (93%), access to specialist resources (83%) and professional development (87%).

2.9.1 Student training, support and engagement

The Doctoral Academy Training Programme (through CARD) ensures generic skills development, timely completion, and employability. All students identify development needs and undertake training and participate in a broader programme via the University Learning and Development Unit or the library. To improve online training UoM funding (£5.5m) supported the Integrated Interdisciplinary Healthcare Science Hub (section 2.6).

Since 2014 we have significantly expanded inclusion of PGR students on Divisional, School and Faculty-level committees, and committees of UKRI funded programmes. Our Doctoral Academy Graduate Society hosts public engagement activities and networking opportunities. Each School has a number of postgraduate prizes, as well as PGR Student of the Year awards at School, Faculty and University level. UoA2 students have won a range of prizes, including 'Best Contribution to PGR Environment 2020', and best student presentations at British Academy of Audiology Conference (2018) and British Society of Gerontology Annual Conference (2018) Stirling Award.

We prioritise wellbeing, including PGR representatives with a remit for mental health and the use of an online 'Pulse-Check' for self-assessment. Office for Students funding (£150k) facilitates monitoring of mental health and trigger points and promotes self-help. Furthermore, we are a partner with the GMHSCP, offering an integrated approach to support via the university and NHS. In 2018-2019 we established a 'PGR Parents' and 'PGR Partners' support groups.

2.9.2 Supervisor eligibility and training

Each student has a primary supervisor and at least one co-supervisor to provide comprehensive, interdisciplinary support. Supervisory teams include a mix of experienced supervisors and ECRs to build our cohort of supervisors. New supervisors must initially act as a co-supervisor, until they have supervised through to completion. The Faculty New Academics and Fellows Programme provides training in supervision, and we provide all supervisors with support on supervisory policy, recruitment, managing relationships and supporting development.

2.9.3 Epidemiology and Public Health

We offer an outstanding research environment for PhD students in public health and epidemiology (including the Chinese Scholarship Council and the Ugandan Cancer Registry). We are considered the pre-eminent group internationally for researching the aetiology of musculoskeletal disorders and effective treatments. We lead the UK Research in Musculoskeletal Epidemiology partnership, and support PhDs in work-related ill-health and environmental epidemiology.

- Pierce (MRC) published papers evidencing our ICS 'Stimulating debate, changing practice and influencing policy in tackling drug-related deaths' (Pierce, **Millar** Drug Alcohol Depend 2015; Pierce, **Jones, Millar** Addiction 2016)

- Walter (MRC) published work from his doctoral research on adverse outcomes following discharge into the community from inpatient psychiatric care (Walter, **Webb** JAMA Psychiatry 2017 and Lancet Psychiatry 2019).

2.9.4 Health Services and Policy Research

Our extensive NIHR infrastructure supports significant capacity building in strategic areas. PSTRC has a vibrant PhD programme, from 2017 allocating around £1m for capacity building. This programme has been extended through co-funding arrangements with SPCR, Christie NHS Trust, School for Social Care Research, and UoM. Our infrastructure funding also supports post-doctoral opportunities, including 3 'launching fellowships' from SPCR to support external applications.

- PhD student Ohrnberger was a Presidential Doctoral Scholar who published a highly cited analysis of the link between physical and mental health (Ohrnberger, **Sutton** <u>Soc Sci Med 2017</u>)

- **Meacock** published influential analyses of a key Government policy around 7 days services (**Anselmi, Meacock, Sutton** <u>J Health Serv Res Policy 2017</u>, **Meacock, Sutton**, <u>Health Econ 2015</u>, <u>section 1.2.2</u>).

2.9.5 Methodology and Data Analytics

Capacity building in informatics and data analytics is another priority area. We have built a PhD cohort, through funding from MRC HeRC, Connected Health Cities and the Wellcome funded HDRUK/Turing PhD programme (see <u>sections 3 and 4</u>), and cross-cutting PhD programmes with our PSTRC and ARC-GM infrastructure.

- **Martin** (MRC) published his studentship findings, proposing an alternative methodology for clinical prediction models (**Martin, Peek, Sperrin** <u>Stat Med 2018</u>)

- Williams conducted a timely analysis of COVID-19's impact on primary care diagnoses during his studentship (Williams, **Brown**, **Campbell**, **Kapur, Webb**, **Peek** <u>Lancet Public Health 2020,</u> <u>section 4.3.1</u>).

2.9.6 PhD Recruitment

We have a robust process for students, including independent assessment of projects and supervisors by the Doctoral Academy, and panel interviews for competitive funding (where all receive Equality & Diversity and Unconscious Bias training). We recruit PhDs from the healthcare professions, and actively enable them to maintain their clinical competencies.

2.9.7 Student progress and monitoring

All research students engage with an online progression monitoring system (e-Prog), which provides milestones, engagement with training, progress and personal development, and structured supervisory feedback, all of which aids timely thesis submission.

2.9.8 Careers and outputs

Our UoM Careers Service helps students identify career pathways, while our funded programmes offer bespoke careers training events, networking events with industry and faculty-wide events though the Doctoral Academy Graduate Society. We ensure that students understand the importance of publishing (see examples of success above) and encourage theses in Journal Format. Presentations are encouraged in internal showcases and conferences. We provide training in communicating to wider audiences (e.g., 'Pint of Science', The Conversation.com).

2.10 Equality, diversity and inclusivity (EDI)

We align with the University strategy for advancing EDI, embedding inclusive practice and creating a structure that includes all staff and students in academic life. A Faculty Committee is chaired by the Associate Dean with wide-ranging representation including BAME, LGBTQ+ and Disabled Staff Networks with 18 Divisional EDI Champions who sit on Divisional Leadership Teams.

Our commitment to EDI is evidenced by our engagement in the career advancement of female academics, through Athena SWAN, Project JUNO and Stellar HE. The School of Health Sciences (including the bulk of UoA2) achieved Athena SWAN Silver status (2018) and is preparing a Gold application. The review panel remarked that, despite significant restructuring,

'sufficient action had been taken to ensure gender equality is embedded in the new structure'; and that 'there was sufficient continuation and appropriate modification of its actions to address the key issues identified by the self-assessment and restructuring processes'.

In conjunction with Athena SWAN, UoM has increased focus on race equality. Data on employment and progression are monitored annually and are almost 100% complete. UoM was initially one of only eight higher education institutions (in 2015) achieving Bronze Status for the Race Equality Charter, an award which was recently renewed. **Esmail** is a patron of the Race Equality Charter working to increase its profile and achieve equal status to the Athena SWAN Awards.

We have dedicated resources to support disabled staff and are a Disability Confident employer, including a guaranteed interview scheme for applicants meeting essential job criteria. We are a Stonewall 'Top 100 Employer' for workplace LGBTQ inclusion (20th in 2018). Since 2019, 82% of the Faculty participants on the University Coaching Programme have been women and 26% identify as BAME. Coaching provision for disabled staff has been commissioned twice.

FBMH launched the pilot flagship Inclusive Advocacy Programme, designed to support high-performing researchers from under-represented groups. A working group is currently addressing barriers faced by BAME individuals in achieving high status. Women in FBMH provides a support network, organising events promoting equality, diversity and inclusion, e.g., Confidence and Personal Impact workshops and International Women's day (attended by 400 staff and students).

2.10.1 Equality and Diversity in UoA2

This REF period has seen significant numbers of appointments of women to senior positions, including Chair (**Checkland, Elliott, Hyrich, Sanders, Verma**), Reader (**Lamb**, **Verstappen**) and Senior Lecturer/Senior Research Fellow (**Anselmi, Camacho, Carder, Coleman, Cotterill, Geifman, Humphreys, Jani, McDonagh, Meacock, Panagioti, van der Veer**).

There are female leads for the School of Health Sciences (Prof Kay Marshall, UoA3), Division (**Verma**) and Centres (**Payne**), as well as our interdisciplinary structures (**Checkland, Verma**). Fourteen per cent of our PGR cohort were from ethnic minorities.

Our research includes work on ethnic minority research participation (**Waheed**) and LGBTQ access to services (**Whittaker**). **Esmail** was invited by the Chief Executive of the NHS to develop the Workforce Race Equality Standard (WRES) in 2014, the main mechanism for assessing NHS performance on race equality.

Esmail served on the editorial committee for a special issue on racial inequality (BMJ 2019) and helped curate the exhibition at the RCGP on the contribution of ethnic minority doctors to general practice on the NHS 70th anniversary.

Our Research Excellence Framework 2021 Code of Practice (2019) complies with EDI legislation and provides a transparent explanation of our approach for our REF2021 submission.

3. Income, infrastructure and facilities

Our staff generated £156.5m in external research income from 85.6 FTE (including £13.6m REF4c funding). This compares to £48m REF2014.

In terms of growth from REF2014, we standardised data on annual income per FTE assuming a 100% return in both REF periods.

- In REF2014, 100% submission would have generated £227,650 per FTE.

- In REF2021, 100% submission generated £261,105 per FTE, an increase of 15%.

Our main sources were UK Central government (mainly NIHR) £78m; Research Councils £19m; Research Charities £20m; UK industry and public corporations £16m; EU £6m.

Grant funding listed in the remainder of section 3 refers to the total award to UoM.

3.1 Research funding and strategies for generating research income

A key ambition from 2014 was to secure larger grants and longer-term infrastructure funding, to maintain interdisciplinary teams to tackle our Grand Challenges, and provide a rich environment for ECRs and PhD students. We created a dedicated Research Strategy and Innovation Team to support applications for large grants.

In line with this ambition, we generated 30 grant or infrastructure awards of more than £1m. These include awards from NIHR (BRC, CLAHRC, SPCR, ARC-GM, PSTRC, PRUs, RDS), MRC and UK Government. Figure 3 shows the links between our infrastructure and the wider research, innovation and health care environment.

Our infrastructure funding included second (PSTRC, PRUComm) and third (NIHR ARC/CLAHRC, SPCR and RDS) tranches, indicating confidence among funders in our impact.

Figure 3: UoA2 Infrastructure and links to the wider context
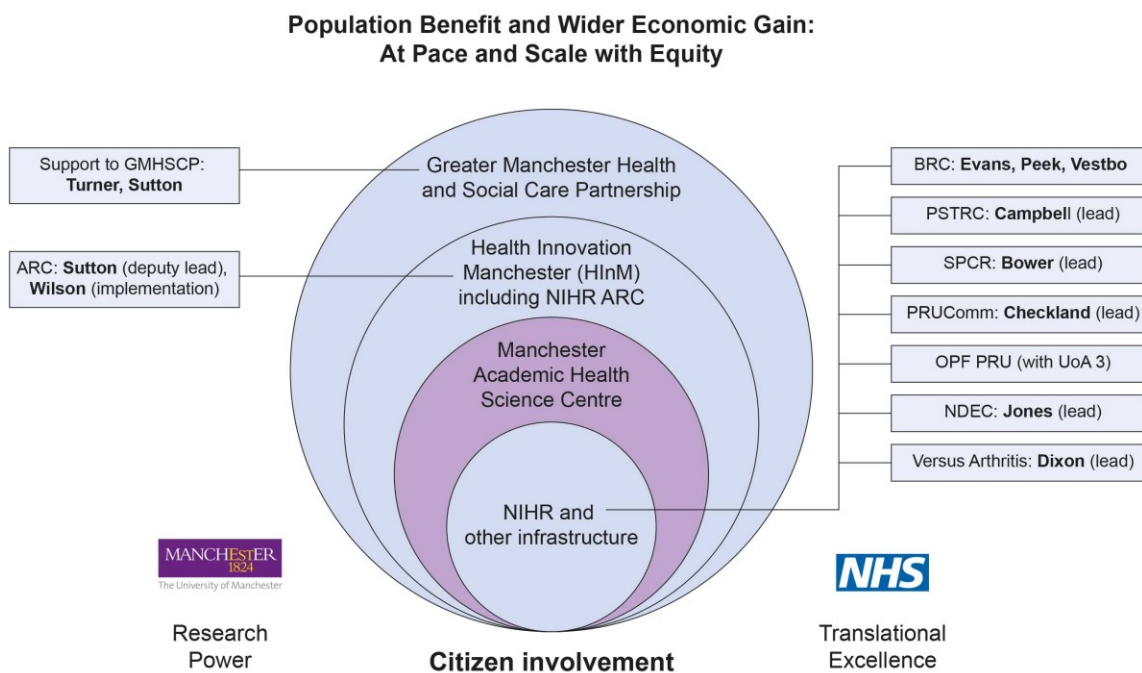
3.2 Externally funded infrastructure and large grants

3.2.1 Epidemiology and Public Health

Biomedical Research Centre	NIHR	£28.5m	Evans, Peek, Vestbo

UoA2 staff lead three themes: 'Cancer Prevention & Early Detection' (**Evans, Renehan**); 'Respiratory' (**Vestbo, Simpson**); and Informatics' (**Peek**). We also support 'Musculoskeletal' (**Felson, Thomson**), 'Dermatology' (**Lunt, Payne**), and 'Biomarker Platforms' (**Geifman**).

Centre for Epidemiology Versus Arthritis	Versus Arthritis	£5m	Dixon, Humphreys, Hyrich, Jani, Lunt, McBeth, O'Neill, Parkes, Sergeant, van der Veer, Verstappen

The Centre has transformed care through patient cohorts to support better clinical decision-making (see ICS 'Biologics registers for immune-mediated inflammatory diseases').

The National Drug Evidence Centre	PHE	£4.25m	Jones, Millar

NDEC is responsible for the management of the National Drug Treatment Monitoring System (NTDMS) for Public Health England. The University of Manchester has been responsible for producing National Statistics from NDTMS since 2003.

Other large grants in the Epidemiology and Public Health theme			
Title	Funder	Award	Staff
Well North (area-level deprivation)	PHE	£9.25m	**Verma**
THOR network	HSE	£1.85m	**van Tongeren**
The musculoskeletal data jigsaw	Nuffield	£1.46m	**Dixon**
'SENSE-Cog' sensory impairment	EU	£1.80m	**Hann, Reeves**
Adult food allergies	UK Gov	£1.84m	**Guo, Verma**
Self-harm & violence in young people	EU	£814k	**Webb**
Exposome project	H2020	£656k	**van Tongeren**
Research in COVID transmission	UK Gov	£460k	**van Tongeren, Verma**
Epidemiological study of mineworkers	Rio Tinto	£543k	**van Tongeren**
Stillbirth prevention in Africa	NIHR	£1.99m	**Sutton, Camacho**
Drugs recovery payment by results	DoH	£999k	**Jones, Donmall**
Psoriasis associated comorbidity	DoH	£2.03m	**Symmons, Lunt, Rutter**
Evaluation of water fluoridation	NIHR	£1.18m	**Sutton, Whittaker**

3.2.2 Health Services and Policy Research

School for Primary Care Research	NIHR	£2.5m	Bower, Campbell, Kontopantelis, Reeves, Checkland, Sanders

We have been a member of this group of elite primary care departments since its inception in 2006 and through three iterations, with the most recent re-designation in 2020. The School has a specific priority around capacity building (section 2.5) and development work to leverage external bids.

Greater Manchester PSTRC (GM PSTRC)	NIHR	£5.9m	Campbell, Elliott, Kapur, Peek, Sanders, Webb

We received a second tranche of 5-year funding in 2017, following the initial £6m award (2012). PSTRC has a focus on the first translational gap, developing innovative products to improve safety. PSTRC has innovated through the use of creative arts (theatre, poetry) and public engagement (Citizens' Juries). Our PSTRC is unique in having a Safety in Marginalised Groups Theme.

ARC-GM	NIHR	£9m	Sutton, Peek, Bower, Wilson (led from UoA3)
CLAHRC GM	NIHR	£20m	Checkland, Sutton (led from UoA17)

ARC-GM was funded in 2018, following two previous CLAHRCs (last in 2014). ARC-GM is focussed on delivering research addressing regional and national challenges, translating findings into practice, and building research capacity.

Policy Research Unit in Commissioning and the Healthcare System PRUComm	NIHR	£1.7m	Checkland, Coleman, Sutton

This unit is a collaboration between UoM, University of Kent and LSHTM. The PRU aims to provide timely evidence to inform Department of Health and Social Care policy on the health and social care systems and commissioning to maximise outcomes for patients. We have received two tranches of funding (in 2010 and 2019).

Policy Research Unit Frailty and Older People (OPF PRU)	NIHR	£2.5m	Bower, O'Neill (Lead from UoA3)

This new policy research unit was funded in 2018 and iUoM, alongside Newcastle University and LSE. The PRU helps the Department of Health and Social Care make decisions about care of older people, through research into healthy ageing, the needs of older people and cost-effective care.

Other large grants in the Health Services and Policy Research theme (PI or Co-I)			
Title	Funder	Award	Staff
Early diagnosis of liver disease	Innovate	£854k	**Payne**
Avoiding patient harm	NIHR	£915k	**Elliott, van Staa, Peek**
Diabetes prevention programme	NIHR	£1.98m	**Sutton et al**
Vanguard programme	DOH	£1.29m	**Checkland, Sutton**
Understanding commissioning	NIHR	£1.07m	**Sutton, Checkland**
Innovation, health and wealth	NIHR	£1.41m	**Sutton**
Enhancing psychological interventions	NIHR	£1.73m	**Bower, Wilson**
Healthy living diabetes	NIHR	£750k	**Cotterill, Elliott, Rutter**
Salford integrated care	NIHR	£872k	**Bower et al**
OCD treatment efficacy trial	NIHR	£1.80m	**Bower, Roberts C**
Prevention of suicide in prison	NIHR	£1.19m	**Carter, Davies**
Mental health care planning	NIHR	£1.55m	**Davies, Bower**
Psoriasis stratification	BAD	£1.40m	**Payne**

3.2.3 Methodology and Data Analytics

Our UoA has the following facilities:

- *Institute for Data Science & AI (IDSAI,* **Guo**, **Peek**)

IDSAI acts as an access point to the UoM expertise in data science and AI and facilitates interactions between researchers and stakeholders, where real-world problems drive the methodology research agenda, providing a natural route to exploiting new approaches.

- *Bede high performance computing platform*

We have access to Bede - the N8's Power and GPU-based high-performance computing platform ideally suited to artificial intelligence and machine learning applications.

- *Alan Turing Institute*

We joined as a partner (2017). **Ainsworth, Guo, Muir, Peek** and **van Staa** are Turing Fellows**.**

- *Christabel Pankhurst Institute for Health Technology*

This £25m institute is led by UoM to maximise our strengths in digital health and advanced materials. It was launched by a £5m award from the Local Growth Fund, with UoM, Manchester Science Partnerships, Manchester University NHS Foundation Trust, and HInM.

- *Manchester Clinical Trials Unit (CTU)* (**Elliott, Sutton C, Verma**)

We transferred the CTU from the Christie NHS Foundation Trust to UoM, to enhance our capability for conducting high-quality clinical research. The CTU employs 55 people, is registered by the UK Clinical Research Collaboration and is funded by NIHR, CRUK, UoM and HInM.

- *North West e-Health*

North West e-Health uses routine health data for clinical trials, delivering the Salford Lung Study (sponsored by GSK) in COPD (**Vestbo** N Eng J Med 2016) and asthma (**Vestbo** Lancet 2017) in one of Greater Manchester's most deprived boroughs.

Other large grants in the Methodology and Data Analytics theme (PI or Co-I)			
Title	Funder	Award	Staff
Connected Health Cities	DoH	£3.99m	**Ainsworth, van Staa, Dixon**
Research Design Service	NIHR	£2.28m	**Vail**
European medical information	EU	£870k	**Ainsworth**
Actionable analytics in primary care	Wellcome	£858k	**Brown**
Risk prediction after MI	EU	£710k	**Peek**, **Martin**
Avoiding harm via safer prescribing	NIHR	£915k	**Peek, van Staa, Elliott**
Improving antibiotic prescribing	NIHR	£916k	**Van Staa, Elliott, Esmail**
The Wearable Clinic	EPSRC	£1.18m	**Ainsworth**
Assistance for psychological therapy	MRC	£1.28m	**Ainsworth**

3.3 Large datasets supporting multiple research projects in UoA2

Access to and capacity for handling large datasets is crucial for our work, and we play an active role in creating, using and sharing these datasets. Critical resources include:

3.3.1 Epidemiology and Public Health

- *British Society for Rheumatology Biologics Register for Rheumatoid Arthritis* for monitoring drug safety in rheumatoid arthritis (**Dixon, Hyrich, Lunt, Symmons**)

- *Biologics in Rheumatoid Arthritis Genetics & Genomics Study Syndicate* of biologic therapy to evaluate response to treatment (**Jani, Hyrich**).

- *BILAG Biologics Register* of therapies for treatment of systemic lupus erythematosus.

- *Norfolk Arthritis Register* cohort of inflammatory polyarthritis (**Humphreys, Lunt, Symmons, Verstappen**)

- *British Association of Dermatologists Biologics & Immunomodulators* of long-term safety of biologic treatments for psoriasis (**Lunt**)

- *Greater Manchester Genomic Medicine Centre* helps to recruit patients with rare diseases and cancer to the 100,000 Genomes Project.

- *The EuroMyositis Registry,* the world's largest register of idiopathic inflammatory myopathies (**Lamb, Ollier**)

- *Multi-centre Study of Self-harm in England* of self-harm episodes (**Kapur, Webb**)

- UK Biobank. **Ollier,** Emeritus Professor was one of a small group to propose this cohort (**Ollier** Pharmacogenomics 2005). We used UK Biobank to explore:

- asthma (**Simpson** Lancet Respir Med 2019)
- breast cancer (**Evans, Harkness** Am J Hum Genet 2019)
- cognitive function (**Ollier** Nat Comm 2018)
- coronary artery disease (**Rutter** Nat Genet 2017)
- diabetes (**Rutter** Diabetes Care 2018)
- educational attainment (**Ollier** Nature 2016)
- psychiatric disorders (**Rutter, Sperrin** Nat Genet 2017)
- sleep (**Dixon, Rutter** Nat Comm 2016)

3.3.2 Policy and health services research

- **Clinical Practice Research Datalink (CPRD).** We have an institution-wide licence to one of the world's largest primary care datasets, linked to hospital and mortality records. **Kontopantelis** is a member of CPRD's Independent Scientific Advisory Committee (ISAC). We host a CPRD User Group for PhDs and ECRs facilitating numerous studies, including:

- antibiotic prescribing and infection (**van Staa** BMC Med 2020)
- cardiovascular disease (**Sperrin**, **van Staa** BMJ 2020)
- diabetes (**Kontopantelis**, **Rutter** Diabetes Care 2017)
- drug dependence (**Millar** PLoS Med 2019)
- epilepsy (**Webb** JAMA Neurol 2018)
- GP performance (**Kontopantelis, Reeves**. BMJ 2014)
- medication safety (**Kontopantelis, Stocks** BMJ 2015)
- self-harm & suicide (**Kapur, Kontopantelis, Webb** BMJ 2017)
- statin prescribing (**van Staa** BMJ 2016)

- **Comprehensive Primary Care Dataset** (**Sutton, Turner**). A collaboration between departments in the SPCR, we have curated these data since 2010 to investigate a variety of topics, including the role of financial incentives (**Sutton** J Health Econ 2018)

- **Trauma Audit and Research Network (TARN)**. Supporting clinical audit, TARN has the largest database in Europe, with 220 hospitals submitting 100,000 trauma cases annually (see ICS 'Radical reorganisation of trauma services')

- **The Health and Occupation Research network (THOR)** surveillance network, to monitor incidence and trends in work-related illness in the UK and Republic of Ireland (**Carder** Br J Derm 2015; **Agius**, **Gittins** Occup Med 2015). THOR provides the Health and Safety Executive with the only medically verified data on incidence, trends and sickness absence burden of occupational disease and work-related ill health, at a national and regional level, and within specific industrial sectors.

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

From REF2014, two key platforms to achieve our strategy are:

- enhancing our internal and external research partnerships and stakeholder engagement

- delivering impact from our research by maximising translation and implementation

4.1 Internal and external research partnerships and stakeholder engagement

We have co-authored papers with researchers from 137 different countries, including 329 papers with 16/20 top-ranked universities (THE World University Rankings), and 348 papers with 19/20 top 20 universities (Academic Ranking of World Universities Shanghai).

We have strong links with Peking University Health Science Center, China. **Anselmi, Stokes** and **Turner** received UoM GCRF seed-corn funding in 2018 to extend collaborations and develop a programme supporting sustainable health in China. The teams conducted bi-directional visits throughout 2018 and joint PhD supervision. **van Tongeren** has led collaborations with the China National Center for chronic disease, Beijing Normal University and China Health Economics Association, including an MRC grant with these partners (**van Tongeren**, **Peek**).

We also have extensive links to the University of Melbourne, Australia in health economics, including a part-time appointment (**Sutton**) and regular visits (**Meacock, Munford**). Additional collaboration has been developed with the Institute of Health Economics (Alberta, Canada), for the evaluation of specialised drugs using real-world data (**Meacock**) and joint PhD supervision.

As well as these strategic partnerships, we are investigators in major international studies:

4.1.1 Multinational clinical trials:

- 'Triple therapy' for COPD (**Vestbo** Lancet 2016, 2017, 2018)
- Effectiveness in COPD patients with comorbid disease (**Vestbo** Lancet 2016)
- Aspirin for hereditary colorectal cancer (**Evans** Lancet 2020)
- Anastrozole for breast cancer prevention (**Evans** Lancet 2020)
- Endometrial scratching for in-vitro fertilisation (**Wilkinson J** N Engl J Med 2019)
- Testing and mortality risk in colorectal cancer (**Renehan** JAMA 2018)

4.1.2 International observational cohort studies:

- Lung-function trajectories in COPD (**Vestbo** N Eng J Med 2015)
- Characteristics of rheumatic diseases in COVID-19 (**Hyrich** Ann Rheum Dis 2020)
- Global epidemiology of psoriasis (**Kontopantelis** BMJ 2020)
- European Male Ageing Study (**McBeth**, **O'Neill**, **Pye** Age Ageing 2016)
- Outcomes of rectal cancer treatment (**Renehan** Lancet 2018)
- Global burden of cancer attributable to BMI (**Renehan** Lancet Oncol 2015)
- Global Burden of Disease Study 2013, 2015 (**Felson** Lancet 2015a, 2015b, 2016)

4.1.3 Global health studies:

- South Africa: Poverty, cash transfers and mental health (**Sutton** Soc Sci Med 2020)
- Thailand: Impact of agricultural pesticides (**Povey** Environ Sci Technol 2015)
- Burkina Faso: Iron and folic acid and genital infections (**Roberts S** BMC Med 2017)
- India and Pakistan: Children with autism (**Emsley** Lancet Psychiatry 2016)
- Kenya: Children with pneumonia (**Peek** BMC Med 2017)
- Mozambique: Health services and child mortality (**Anselmi** Lancet Global Health 2014)

Below we describe partnerships and collaborations in our core themes.

4.1.4 Epidemiology and Public Health

We are members of the Northern Universities Public Health Alliance (NUPHA), a voluntary organisation that fosters collaboration in the academic public health community. NUPHA is supported by the NHSA to develop public health regionally.

Our epidemiology and public health researchers have been engaged in several EU-funded research projects during this REF period, including leadership of the European Urban Health Indicator System (**Verma**), a project on the exposome (**van Tongeren**) and examining the determinants of self-harm and violence among young people using Danish registry data (**Webb**).

Verma was invited onto the round table for Prof Sir Michael Marmot's 10 year follow up of the 'Marmot Report' and has been working to develop GM as a 'Marmot City Region', including improvements in school readiness that have been widely reported.

4.1.5 Health Services and Policy Research

Our NIHR infrastructure is a critical platform for collaboration.

The SPCR conducts collaborative research across the nine top-rated primary care departments in England judged by an international panel, including large-scale joint research projects (such as the £1m Evidence Synthesis Working Group **Hodkinson, Panagioti**) and capacity building (**Blakeman, Checkland**).

UoA2 investigators contribute to two NIHR PRUs (**Checkland, Coleman, Bower, O'Neill,** section 3). These units collaborate closely with DHSC and other policymakers, and also form a national network across the 15 PRUs to tackle cross-cutting issues.

During this REF period, our health service and policy researchers have participated in large, international collaborations through EU projects on new professional roles and on integrated care for people with multimorbidity (**Sutton**) and development of a system to reduce adverse medication safety incidents in elderly patients (**Esmail, Reeves,** BMJ 2020).

4.1.6 Methodology and Data Analytics

Our HeRC (2013-2018, **Ainsworth, Peek**) was a virtual network uniting data science across Northern England, including universities of Bradford, Lancaster, Liverpool and York; the NHS, the Northern Academic Health Science Network, the NHSA and MAHSC.

HeRC also supported global collaborations, with the American Medical Informatics Association, the International Medical Informatics Association, WHO and Harvard University.

Recruitment to clinical trials remains a priority and we have contributed to the MRC North West Hub for Trials Methodology Research and the MRC Network of Hubs (**Bower, Kirkham**), and now the MRC-NIHR Trials Methodology Research Partnership (**Sutton C**). **Bower** is a national speciality lead for the NIHR Clinical Research Network, with research on recruitment methods, the equitable distribution of research (BMC Med 2019) and the link between research and quality of care.

4.2 Delivering impact from our research by maximising translation and implementation

We have several audiences for our research, with a particular focus on policymakers and patients. Below we outline how we ensure that our research influences decision-making.

4.2.1 Policymakers

Our policy research units foster engagement with policymakers at DHSC. All PRUComm projects (**Checkland, Sutton**) have a 'policy customer'. PRUComm hosts an annual seminar for DHSC policymakers and NHS England senior managers, and IHPO hosted an 'away day' for around 15 senior civil servants from DHSC. This event fostered ongoing relationships and requests for academic support for policymakers in DHSC and beyond. For example, in June 2020 **Checkland** met with an Assistant Secretary from the Australian Government Department of Health to advise on networks of primary care practices.

Our work has led to mutual secondments; **Anselmi** has worked for 6-month periods at DHSC collaborating with their analysts to update the national formula for the Advisory Committee on Resource Allocation: such work improves outcomes as independent research on our previous formulae has shown. The NIHR PRU for Older People and Frailty (**Bower, O'Neill**) engages with policymakers by responding to rapid requests for evidence as well as strategic commissions.

Our specialist policy support unit ('Policy@Manchester') facilitates engagement, including a publication addressing important policy issues ('On Primary Care'). This led to three research events with NHS England, DHSC, the Royal Pharmaceutical Society and the Local Government Association.

We have given oral evidence to House of Commons Select Committees (**Checkland, Sutton**). **Checkland** gave oral evidence to the House of Commons Health and Social Care Select Committee Inquiry on 2nd April 2019 into proposals for legislative change in the NHS, with her evidence cited in the Inquiry report. We also work with relevant All Party Parliamentary Groups to address particular priorities.

Our close links with RCGP, Health Education England and the GMC (**Checkland, Spooner**) provide additional avenues to influence policy. For example, **Spooner** supported an RCGP campaign to enhance recruitment to general practice.

We have a formal Memorandum of Understanding with NICE, with NICE staff holding honorary positions. Our investigators contribute to multiple NICE activities, including chairing the Depression guideline panel (**Kapur**) and engagement in HTA assessment (**Elliott, Payne, Bower**). We have a close working relationship with the HSE and won a framework contract with HSE to act as preferred bidder to meet their research needs (**Van Tongeren**)**.**

4.2.2 Patients and the Public

Patient and Public Involvement and Engagement (PPIE) are embedded throughout our activities.

4.2.2.1 Epidemiology and Public Health

Our Centre for Epidemiology Versus Arthritis includes a vibrant user group, established in 2009. The Centre developed the innovative '*Cloudy with a Chance of Pain*' (**Ainsworth, Dixon, McBeth, Sanders, Sergeant, Sperrin**), using digital tools to track the link between weather and pain. This project attracted international media attention and is a model for patient engagement at scale.

4.2.2.2 Health Services and Policy Research

Our PRIMER group (formed 2008) was the first in the UK to focus on primary care (**Morris, Sanders**), and was recognised as a 'top ten' SPCR achievement and flagged as an impact case in the RAND synthesis of NIHR case studies.

The PSTRC (**Campbell**) invested 10% of its funding in PPIE and has developed a range of innovations. This included work with the 'Museum of Homelessness' charity (**Sanders**) with interactive exhibitions, as well as poetry and spoken word workshops to explore safety in mental health. PSTRC collaborated with the Patients' Association and the James Lind Alliance on priority setting for patient safety. The PSTRC has also developed resources to guide PPIE for people with lived experience of self-harm (**Kapur, Webb**).

4.2.2.3 Methodology and Data Analytics

We have engaged with patients to produce innovations, using co-design to develop technologies to capture patient experience, outcome and safety data: DEPEND (**Sanders**); REMORA (**Dixon**); and MRC ClinTouch/Careloop/Actissist (**Ainsworth**).

The #datasaveslives initiative used social media to engage with the public on use of health data. It was adopted by NHS England, NHS Digital, Wellcome Trust and HDRUK, and our analyses showed multiple uses, including event reporting, encouraging participation, and showing support for data sharing (**Hassan** JMIR 2019).

We ran workshops exploring new ways to consent for research and the use of health data ('dynamic consent' **Sanders, van Staa**). Our PSTRC 'Citizens' Juries' investigated public attitudes to data sharing, disseminating results to the National Data Guardian and the All-Party Parliamentary Group on Medical Research. We also commissioned Citizen's Juries to explore the role of AI in stroke diagnosis and decisions about rehabilitation. The results have informed national guidance developed by Information Commissioner's Office and the Alan Turing Institute.

4.2.2.4 One Manchester PPIE forum

Although the diversity of our patient contributors is a strength, co-ordination is challenging. We developed a 'One Manchester' approach through the GM Public and Community Involvement and Engagement Forum (**Sanders**). We mapped PPIE strategies and activities across GM; worked to support best practice; and developed shared activities to enhance impact. The group includes PPIE leads from the Voluntary Community and Social Enterprise Sector.

4.3 Wider contributions to the economy and society

4.3.1 COVID-19

Our expertise in advanced analytics of large datasets has enabled us to generate robust evidence for the multiple harmful effects of the pandemic on population health. The impact of COVID-19 has varied regionally and has been experienced disproportionately among people who are deprived, care home residents, and those with existing health problems.

Our research teams have responded rapidly to the emergency. For instance, the GM Care Record (GMCR, **Peek**), interlinked primary and secondary care data for 2.8 million people, has been made rapidly available for conducting COVID-19 impact studies.

We have also informed the NHS and wider response with a focus on deprivation and vulnerable groups, including our involvement in the Care Homes Working Group feeding into SAGE (**Verma, Morciano**).

In response to COVID-19 we have:

- assessed COVID-19 prognostic models through a rapid review (**Sergeant, Sperrin** BMJ 2020)

- examined COVID-19's impact on excess deaths regionally (**Kontopantelis** J Epidemiol Community Health 2020) and by gender (**Kontopantelis** Mayo Clin Proc 2020), and in specific clinical groups (**Hyrich** Ann Rheum Dis 2020)

- demonstrated the impact on mental health (**Kontopantelis**, **Webb** Lancet Psychiatry 2020)

- demonstrated changes in clinical practice that have occurred due to the pandemic, such as marked reductions in diagnoses (**Brown, Campbell, Kapur, Webb Peek** Lancet Public Health 2020), of recorded self-harm episodes (**Webb, Kapur** Lancet Public Health 2021), and treatments in specific clinical populations (**Dixon** Lancet Rheumatol 2021)

Munford contributed to the NHSA report on COVID-19's impact in the North of England, covered by BBC Radio and News, Daily Mirror, Guardian and Daily Mail. **Morciano** analysed care home deaths due to COVID-19 alongside Hall (UoA10) (**Morciano, Stokes, Kontopantelis, Turner** BMC Medicine 2021), presenting to Helen Whately (Minister of State for Social Care) to inform policy.

van Tongeren leads our work in the COVID-19 National Core Study on Transmission and Environment (PROTECT), aiming to identify the key transmission routes and effective strategies to block them. **van Tongeren** also leads MRC funding on COVID-19's impact on the gig economy.

4.3.2 Devolution of health and social care (Devo Manc)

Our researchers (**Coleman, McDonald, Sutton, Turner**) are funded by the Health Foundation to evaluate the devolution of health and social care budgets, with GMHSCP. Our work has fed into development of the GM Population Health Outcomes Framework and the Benefits Realisation Dashboard, which track regional performance. We are active members of both the GMHSCP Locality and Population Health Evaluation groups, providing advice on research in each of ten GM localities.

UoM has invested in the development of a data resource, the GM Population Research Resource (GMPRR), which will bring together person-level linked data from administrative databases across the public sector with information collected from participants via apps. This is being developed jointly with the Chan School of Public Health (Harvard). Its initial twin focus is on two GM priorities: improving life readiness amongst adolescents and young adults, and community support for the health and well-being of older people from minority ethnic groups.

4.3.3 Improving access to care

GM CLAHRC evaluated initiatives to enhance access to general practice through additional appointments at evenings and weekends (**Whittaker**). Our evaluation demonstrated that these changes contributed to 8% fewer A&E attendances. We also highlighted keys to successful implementation, encouraging wider adoption (**Whittaker** PLoS Med 2016). Our work underpinned the decision to implement the scheme across Greater Manchester, justified a wider national scheme (Prime Minister's Challenge Fund) and was cited in NHS England guidance on urgent care. Subsequent regional evaluation confirmed that primary care patients had access to an additional 50,000 appointments.

Former Chief Medical Officer (CMO) for England Professor Dame Sally Davies described our work as 'a strong example of how CLAHRC can impact on high priority areas and ensure that planning decisions are evidence-based'.

4.3.4 Learning health systems

Our research drives development of the concept of 'learning health systems', which also underpins our future strategy (section 1.3.4). We identified major opportunities to improve health systems by exchanging conventional intelligence pipelines for networked masses of data, methods and expertise (**Ainsworth** Methods Inf Med 2015). This underpinned funding of the Farr Institute Health eResearch Centre (HeRC) (**Ainsworth, Dixon, Peek, van Staa**), funded by MRC, ESRC, EPSRC and NIHR.

In 2014, the Prime Minister and Chancellor agreed the 'Health North' plan, and in 2016, the Connected Health Cities bid was launched (CHC). CHC informed the development of the Digital Innovation Hub in the Life Sciences Industrial Strategy. CHC linked over 10m records in the North of England, and generated over £30m investment, creating new jobs and supporting partners to develop products with the NHS. CHC brought together 20 NHS Trusts, 550 practices and 10 universities to improve care through joint working. The Great North Care Record is accessed 1.5m times annually and is saving the North East's NHS at least £8m a year. CHC also established Trustworthy Research Environments within regional Data Arks to deliver common governance, allow research to meet required standards, and support data-driven innovation.

Connected Health Cities informed the development of the NHS England Local Health and Care Record Exemplars (LHCRE, £37.5m). LHCRE aimed to improve how the NHS and its partners share information securely to improve population health. In GM, LHCRE is investing over £14m to support better care, representing £6.8m from the GMCA and £7.5m from the GMHSCP. In 2020, we received funding as part of the HDR Better Care North (£1.2m).

4.4 Evidence of the unit's contribution to the sustainability of the discipline

A national priority has been the development of health economics. We returned six health economists in REF2014 and 18 in this return. This reflects new appointments (**Elliott, Morciano**) and promotions (**Anselmi, Meacock, Munford**).

Our health economists have led the development of the discipline nationally and internationally; for example, by forming a chapter within the International Society of Pharmacoeconomics and Outcomes Research (ISPOR) (**Payne**), an ECR Committee within the European Health Economics Association **(Meacock, Munford)** and by leadership of the UK Heath Economists' Study Group and the NIHR Economics Group (**Sutton**).

The next phase of the SPCR will have an explicit focus on working with primary care departments outside the formal structure to better share expertise and capacity to meet the challenges of health care in the North.

The PSTRC (**Campbell**) collaborates across the three NIHR centres (Imperial and Bradford-Leeds), and runs a National Patient Safety Doctoral student network.

ARC-GM is engaged with national collaborations on ageing and on health inequalities across the 15 ARCs, and we provide national leadership on the NIHR priority discipline of economics (**Meacock**, **Sutton**).

The Digital Domain has built an active community (~350 members) through networking events. The Manchester Connected Health Ecosystem is a collaborative network that brings together academic expertise, industry partners, NHS and social care professionals, local government, and patients.

4.5 Indicators of wider influence, contributions to and recognition by the research base

- **Kapur** 2021 American Association of Suicidology Louis I Dublin Award lifetime achievement award for his research in suicide prevention; the first UK winner in 20 years

- **Evans** Freidrich von Recklinghausen award 2014 (Children's Tumor Foundation), Sir Patrick Forrest Prize 2016/2017 (British Breast Group), and Theodor Schwann award 2018 (European NF Group).

- **Vestbo** Hagedorn Prize and Medal in 2016, a prestigious prize in Danish Internal Medicine.

- **van Staa** Iain I Boyle Award (European Calcified Tissue Society) for osteoporosis research

UoA2 investigators have the following Fellowships:

- Faculty of Clinical Informatics (**Brown**)
- Royal College of Obstetricians and Gynaecologists, Learned Society of Wales (**Evans**)
- European Respiratory Society (**Vestbo**)
- American College of Medical Informaticians (**Peek**)
- Alan Turing Institute (**Ainsworth, Guo, Muir, Peek, van Staa**)
- Royal Pharmaceutical Society (**Payne, Elliott**)
- Faculty of Public Health (**Verma**)
- NIHR Senior Investigators (**Bower, Sutton**)

UoA2 investigators have taken part in 69 funding panels for national and international funders and charities. Roles include Chair of the Pharmacy Research UK Scientific Advisory Panel (**Elliott**), Deputy Chair of the NIHR Health Services and Delivery Research Funding Committee (**Sutton**), Chair of the NIHR funding panel for AI in Health and Care (**Bromiley**) membership of the MRC Population Systems Medicine Board (**Dixon**) and Scientific Advisor for the American Foundation for Suicide Prevention (**Webb**).

We have undertaken 41 editorial roles since 2014, including Chief Editor of *Implementation Science* (**Wilson**) and BMJ statistical editor *BMJ* (**Kirkham**). We have been involved in 19 consultation projects for overseas governments and organisations, including six for WHO.