

**Institution:** University of Leicester

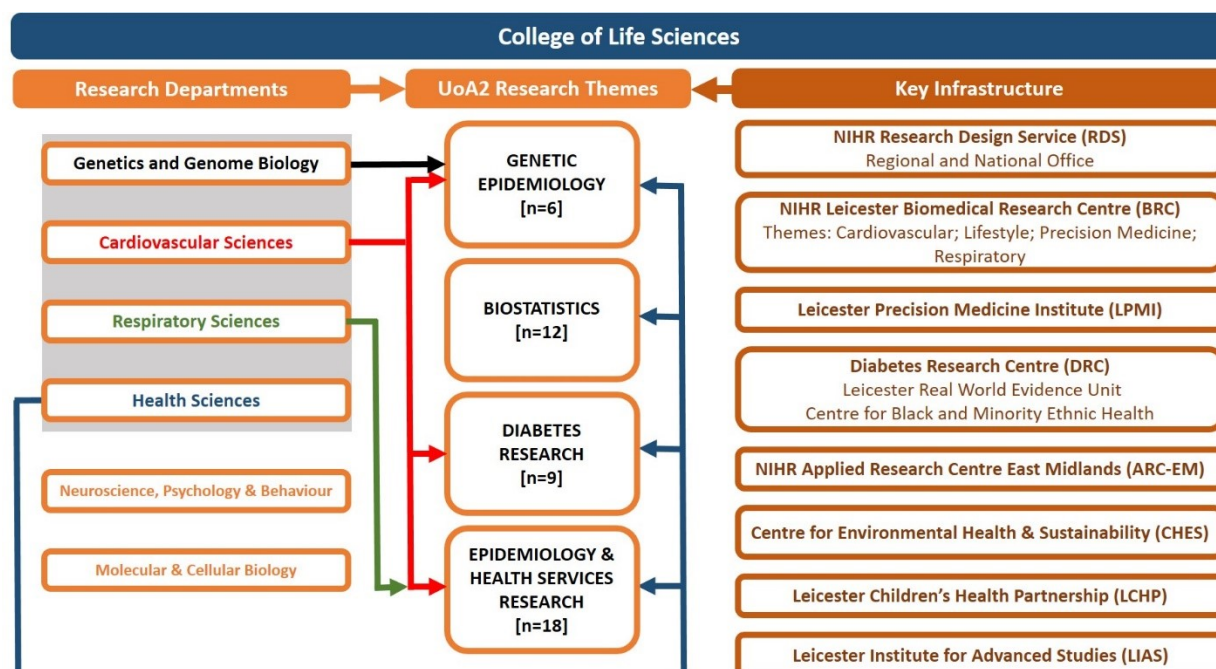
**Unit of Assessment:** UoA2 Public Health, Health Services and Primary Care

## Section 1. Unit context and structure, research and impact strategy

### 1.1. UNIT OVERVIEW

Leicester has an international reputation for excellence in health and healthcare research, epidemiology, and methodological innovation. We have continued to realise our aim of improving population health through strategic leadership of high quality methodological and applied research programmes, training future generations of research leaders, and ensuring the impact of our research on health, policy and practice worldwide.

Our submission comprises 45 staff (42.4 FTE), expanding from 26 (24.2 FTE) in REF2014, reflecting major strategic investment, structural reorganisation, and sustained growth over the assessment period. Following an external review in 2015, the 10 teaching and research departments within the College of Medicine, Biological Sciences & Psychology were restructured into six research departments and four teaching schools within the renamed College of Life Sciences (CLS). Staff in our unit are based in four of the six research departments, the majority (75.6%) in Health Sciences with others in Cardiovascular Sciences, Respiratory Sciences and Genetics & Genome Biology. This structural reorganisation, alongside continued development of sustainable infrastructure (Figure 1), has significantly enhanced our research capacity and the development of interdisciplinary collaborations amongst staff across this unit and the wider institution.



**Figure 1.** Organisational structure of CLS, including key institutional infrastructure. Each research theme shows the number of staff returned in UoA2 and their integration within departments.

Our research has two complementary, overarching aims:

- (i) Evaluate medical, technological and social interventions to improve health and healthcare services and inform health policy decision making.
- (ii) Investigate the causes, consequences, treatment and management of chronic and complex conditions to improve health and wellbeing across the lifespan.

Our staff work within research groups embedded in four interdisciplinary themes (Figure 1): **Genetic Epidemiology; Biostatistics; Diabetes Research; and Epidemiology and Health Services Research.**

We have achieved our strategic aims outlined in REF2014 by: (1) expanding research capacity and infrastructure through strategic investment and increased external income; (2) facilitating team science and interdisciplinary collaboration through structural reorganisation; (3) increasing PhD student numbers and improving support for postgraduate research (PGR) students and early career researchers (ECRs); and (4) advancing public and patient engagement with consequent impact on impact on health, healthcare systems and societies worldwide. This is evidenced by our increased income and sustained production of high-quality research, outputs and impact over the assessment period, as follows:

- Our **research income totalled £57.4M** (including 12.6M NIHR in-kind), **a 70% increase from REF2014.**
- We published **1,934 scientific outputs (45.6 per FTE)**, attracting 54,789 citations (28.3 per output) with an average Field Weighted Citation Index (FWCI) of 3.11. Overall, 55% of our outputs are ranked in the top 10% most cited journals worldwide, 49% involved international collaboration and 13% industrial collaboration.
- We **supervised 82 PGR students to doctoral awards, an increase from 31 in REF2014**, with many achieving external awards for excellence and supported by prestigious fellowships, including 10 NIHR doctoral fellowships.
- Our methodological innovations have **improved health policy decision making worldwide** and our research has **enhanced standards of care and health and wellbeing across the lifespan**, from improved maternity and neonatal care, prevention and management of Type-2 Diabetes, to improved outcomes for older people.

Leicester is **one of the three top performing UK universities for COVID-19 research.** Our staff are leading investigators of the £2M UKRI-NIHR-funded UK-REACH Study to understand mechanisms and increased risk of morbidity and mortality associated with COVID-19 in Black, Asian and Minority Ethnic (BAME) healthcare workers, and the £8.4M national UKRI/NIHR-funded PHOSP-COVID study of outcomes following hospitalisation with COVID-19.

Key developments that have supported our increased capacity for research include:

- Major strategic investment including the new **£42M George Davies Centre for Medicine**, the largest capital investment in medical teaching and applied research by any UK university in the last decade.
- Leading the **Leicester Diabetes Research Centre (DRC)** and **NIHR Applied Research Collaboration East Midlands (NIHR-ARC-EM; £10.8M)**, facilitating interdisciplinary

research in diabetes, multi-morbidity, mental health and well-being, ethnicity and health inequalities, and service improvement.

- Establishing the **Centre for BAME Health** to address health inequalities through interdisciplinary research into the health concerns of BAME and other marginalised groups.
- Establishing the **Centre for Environment, Health and Sustainability (CEHS)** through institutional investment and philanthropic donations totalling £5M creating a pioneering national research centre investigating the effect of environmental exposures on health.
- Establishing the **Leicester Children's Health Partnership** with University Hospitals of Leicester (UHL) NHS Trust and Leicester City Football Club (LCFC) to facilitate research investigating factors affecting the health and wellbeing of children in our local population.
- Securing funds for the **NIHR Leicester Biomedical Research Centre (BRC; £11.5M)** bringing together 75 FTE researchers across the university with cross-cutting Cardiovascular, Lifestyle, Respiratory and Precision Medicine themes.
- Leading the **NIHR Research Design Service (RDS) East Midlands** and the **RDS National Office**, setting the strategic direction for the RDS as a national service.
- Co-leading the **BREATHE Health Data Research UK (HDR-UK) Digital Innovation Hub** and partnering in **HDR-UK Midlands** facilitating the use of large-scale health data in cutting-edge respiratory health and care research and innovative data science.

## 1.2 RESEARCH THEMES AND STRATEGIC AIMS

Translation of our research to practice has had a major impact on improving population health by driving standards of care and informing improvements in health and healthcare policy. Our research is centred around four themes.

### 1.2.1 Theme 1: Genetic Epidemiology

This group comprises staff from the Department of Health Sciences' Genetic Epidemiology Group [**Wain, Dudbridge, Sheehan, Guyatt**, (and Tobin: UoA1)] and the Departments of Genetics and Genome Biology [**Brookes**] and Cardiovascular Sciences [**Nelson**]. Their research includes large-scale discovery genomic epidemiology to advance drug development and precision medicine, and the development and application of novel statistical methods for genomic, aetiological and integrative epidemiology in collaboration with staff in the biostatistics theme. They are global leaders in demonstrating proof-of-concept for genetic prediction of complex disease and in methodological developments for dealing with confounding, reverse causation and selection bias in epidemiological studies. They support capacity building in social science, law and ethics, and public engagement through their PhD Programme in Genomic Epidemiology and Public Health Genomics.

Key funding includes a £5.2M UKRI award for the PHOSP-COVID Study of health outcomes following COVID-19 hospitalisation [**Wain**; PI Brightling UoA1]; £0.7M from GlaxoSmithKline (GSK) for the Respiratory Genetics Collaboration, a strategic collaboration to aid the development of new medicines for Chronic Obstructive Pulmonary Disease (COPD) and related airway disorders [**Wain**]; and £0.4M MRC funding for the use of genetic associations to account for selection bias in epidemiological studies [**Dudbridge, Sheehan, Wain**]. Staff in this theme [**Guyatt, Wain**] also collaborate with staff in the Epidemiology and Health Services Research [**Pareek** (PI)], Diabetes Research [**Khunti**] and Biostatistics [**Abrams; Gray**] themes in the UK-REACH Study (£2M; see Section 1.2.5) and co-lead the BREATHE HDR-UK Digital Innovation Hub (£663k), a national collaboration between patients, public,

academia, third sector and government organisations, and industry facilitating the use of large scale health data to improve respiratory health and care.

Key achievements include:

- Publishing 325 outputs (58 per FTE) cited 25,694 times with a FWCI of 5.74; 45% of outputs were in the top 10% of publications cited worldwide; 78% involved international collaboration and 40% corporate collaboration.
- Leading and contributing to discoveries transforming knowledge of the genetic determinants of a wide range of common, complex diseases and associated traits including lung function and COPD, leading international efforts to increase the number of associated loci to 279 [Wain; *Lancet Resp Med*;2015;FWCI12.8][Guyatt; *Nature Genetics*;2019;FWCI8.95]; pulmonary fibrosis [Wain; *Lancet Resp Med*;2017;FWCI8.19], and coronary artery disease [Nelson; *Nature Genetics*;2017;FWCI15.03]; and leading international efforts increasing the numbers of associated loci in other complex diseases. [Wain; *Nature*;2015;FWCI15.89].
- Leading state-of-the-art research in the genetic prediction of complex disease, such as establishing that individuals can be stratified by their genetic risk for cardiovascular disease, enabling accurate age-stratified screening strategies in conjunction with conventional risk factors [Dudbridge/Sweeting; *JAmCollCardiol*;2018;FWCI16.81].
- Establishing the longitudinal population-based EXCEED cohort of over 10,000 participants to address local health priorities, genomics, drug discovery and multimorbidity through linked healthcare records. EXCEED has contributed to grants totalling >£17M since 2015 and 16 separate studies utilising the cohort are currently underway. EXCEED is instrumental in the PHOSP-COVID study recruiting BAME participants to study the health outcomes and impacts of COVID-19.
- Leading methodological advances in epidemiology, including fundamental work on Mendelian randomisation [Sheehan; *StatsMed*;2017;FWCI16.14] utilised in high impact applications [Dudbridge; *Lancet Diabetes*;2016;FWCI4.58] and pioneering new approaches using genetic data to adjust for selection bias in epidemiological studies [Dudbridge; *NatureComm*;2019;FWCI2.09].

### 1.2.2 Theme 2: Biostatistics

Staff [Abrams, Bujkiewicz, Cooper, Crowther, Gray, Lambert, Major, Owen, Rutherford, Sweeting, Sutton, Yao] pursue cutting-edge methodological and applied research. Their methodological developments encompass a range of areas including evidence synthesis, decision modelling, and survival analysis with applications to various disease areas including cancer, diabetes and cardiovascular disease. These novel methodologies are used extensively internationally, thereby advancing research, policy and practice worldwide (see ICS1).

The success of the group's methodological work is reflected in external funding awarded for methodological development, including 4 MRC Methodology Research Panel grants covering evidence synthesis and survival analysis, 19 NIHR fellowships, and project grants for disease-specific research (Cancer Research UK (CRUK)/British Heart Foundation (BHF)).

Staff in this theme contribute significantly to national research capacity and leadership in this area. Abram (with Brookes; Genetic Epidemiology Theme) co-lead the HDRUK Midlands Site (£781k) and our staff make a substantial contribution to health policy decision making

through the development of methods for, and membership of, the NIHR Complex Reviews Support Unit [**Cooper** (Deputy Director); **Abrams**; **Sutton**], NICE Decision Support Unit [**Abrams**, **Bujkiewicz**, **Crowther**, **Lambert**, **Rutherford**, **Sweeting**], NICE Technology Appraisals Committee [**Owen**], NICE Diagnostic Advisory Committee [**Abrams**] and NICE Public Health Advisory Committee [**Yao**] (Section 4).

Supporting their aim to improve applied health research and facilitating integration of their methodological innovations into practice, staff in this unit are co-investigators on numerous large collaborative grants, including the NIHR/MRC funded UK-REACH Study [**Abrams**, **Gray**; Section 1.2.5], NIHR-ARC-EM [**Abrams** (Data2Health theme lead), **Gray**], joint CRUK/BHF programme grants to create the world's largest cardio-oncology database [**Lambert**, **Sweeting**], and the International Cancer Benchmarking Partnership (ICBP) [**Lambert**, **Rutherford**]. They also deliver specialist training courses including training for NICE Committees and pharmaceutical companies [**Abrams**, **Crowther**, **Rutherford**, **Owen**, **Bujkiewicz**], and they develop freely available software for use worldwide to support translation to practice. They also undertake collaborative work to ensure innovative methodology is integrated in all Leicester's health related research. With the Genetic Epidemiology theme, they organise methodological seminars that are attended by statisticians and other researchers across CLS.

Key achievements include:

- Publishing 392 outputs (36 per FTE), cited 7326 times; 48% are in the top 10% of journals and 45% involved international collaboration.
- Pioneering methods developed by staff in this theme are routinely used in NICE Health Technology Assessments, the pharmaceutical industry, healthcare consultancy companies making submissions to NICE, and similar organisations worldwide. Staff led or contributed to NICE Decision Support Unit Technical Support Documents on Evidence Synthesis, Advanced Survival Methods, Population-adjusted Indirect Comparisons, Multivariate Meta-Analysis and Treatment Switching, and to updating the NICE Methods Guide (**Abrams** ICS1).
- Survival analysis methods [e.g. **Crowther**; *StatsMed*;2017;FWCI3.56] developed at Leicester are used routinely in analyses of major international epidemiological studies, particularly cancer registration data, including national and international cancer comparisons such as the ICBP [**Lambert**; *LancetOncol*;2019;FWCI16.86] [**Lambert**; *JCO*;2016;FWCI15.97] [**Rutherford**; *Lung Cancer*;2014;FWCI8.56].
- Facilitating high profile applied research through national and international collaborations thereby transferring their methodological developments into practice, e.g., using registry data to set benchmark revision rates [**Crowther**; *BMJ*;2015;FWCI4.34], major trials in influenza [**Abrams**; *HTA*;2014;FWCI3.46] [**Yao**; *Lancet*;2015;FWCI5.16] and decision models to assess benefit, harms, cost-effectiveness of screening women for abdominal aortic aneurysm [**Sweeting**; *Lancet*;2018;FWCI44.37].

### 1.2.3 Theme 3: Diabetes research

Staff [**Dunkley**, **Gillies**, **Kadam**, **Khunti**, **Lawson**, **Papamargaritis**, **Seidu**, **Webb**, **Zaccardi**] work within the Departments of Health, Cardiovascular and Respiratory Sciences and collaborate closely with staff in UoAs 1 and 24. They are part of the Diabetes Research Centre (DRC) [**Khunti** co-lead with Davies (UoA1)], a multidisciplinary collaboration between UoL, UHL NHS Trust and three Leicester Commissioning Groups. It is the only UK centre of



its type recognised by the International Diabetes Federation as a Centre of Excellence. Staff in this theme carry out translational lifestyle and drug-related research focused on developing and evaluating novel methods of preventing and managing diabetes and other long-term conditions, including cardio-metabolic diseases and obesity. They also lead epidemiological studies and evaluations of novel clinical interventions including exercise, diet, incretins and complex primary care interventions including behaviour change and self-management. Situated in Leicester, the DRC is uniquely placed to build on the increasing prevalence of Type 2 Diabetes in BAME populations. Notably, Leicester was chosen as the first City in UK for the 'Cities Changing Diabetes' initiative, an international programme addressing the prevention and management of Type 2 Diabetes in urban settings.

As well as being a key element of the BRC the DRC hosts the NIHR-ARC-EM [Khunti, £10.8M 2019-2024] which builds on the previous NIHR-CLAHRC (2013-2019, £11.8M) and undertakes research in multi-morbidity, mental health and well-being, building community resilience and enabling independence, ethnicity and health inequalities, and service improvement. The ARC-EM hosts the Leicester Real World Evidence Unit, providing support for the design and delivery of high-quality real- world studies, and the Centre for BAME Health addressing health inequalities through leadership and support for interdisciplinary research into the health concerns of BAME and other marginalised groups. Staff in this unit [Khunti] collaborate on the UK-REACH Study (Section 1.2.5) and lead a Novo Nordisk study investigating the impact of COVID-19 lockdown on the lives of people with obesity [£210k Gillies (PI), Zaccardi]. The link across the NIHR-ARC-EM and the Leicester BRC is used by NIHR as an exemplar of good practice.

Key achievements include:

- Publication of 616 outputs (70 per FTE), cited 12,209 times with a FWCI of 3.20. Almost half were in the top 10% of journals with 46% involving international collaboration and 12% corporate collaboration.
- Key trials on interventions to prevent cardiovascular disease [Khunti;NEJM;2015;FWCI63.2], [Khunti;Circulation;2017;FWCI40.1] and large scale observational studies utilising CPRD [Lawson;Circulation:Heart Failure;2020].
- The Real World Evidence Unit has grown from initial concept to a Unit employing 9 statisticians supporting diverse projects and attracting £1.2M funding from industry partners including NOVO Nordisk, Sanofi, Boehringer Ingelheim, AstraZeneca, Nuffield and MSD.
- Establishing and expanding the Centre for BAME Health which has been crucial to establishing the UK-REACH and PHOSP-COVID studies.
- The first to highlight links between ethnicity and COVID-19 [Khunti;BMJ;2020] and leading research into its disproportionate effect in BAME populations. Our staff also published several rapid reviews on personal protective equipment which have been used by health care professionals nationally [Khunti;BJGP;2020].
- Transforming standards of care resulting in health and economic benefits worldwide through improved early detection, prevention and management of Type 2 Diabetes (ICS3).

**1.2.4 Theme 4: Epidemiology and health services research**

Staff [Armstrong, Baggaley, Boyle, Brunskill, Conroy, Draper, Gaillard, Hansell, Holland, Mackintosh, Manktelow, Pareek, Sayers, Smith, Steiner, Tarrant, Williams, Wozniak] are situated across the Departments of Health, Cardiovascular and Respiratory

Sciences. Their research encompasses several clinical areas spanning the lifecourse from pregnancy and childhood through to old age, and addresses multiple chronic conditions, environmental epidemiology, and healthcare delivery and improvement. Their work draws upon a range of approaches including epidemiology, evidence synthesis, decision analytics, ethnography and other qualitative methods to develop, evaluate and implement interventions. They also develop methodological approaches to improve the quality of healthcare delivery. Staff work within research groups on focused subject areas whilst fostering interdisciplinary collaborations between themes both within this unit and across the institution. Key research groups are:

The Social Science APPLIED to Healthcare Improvement Research (SAPPHIRE) group which has expertise in applying social science theory and methods in healthcare improvement. The group is an academic partner of The Healthcare Improvement Studies (THIS) Institute, a £42M venture led by the University of Cambridge to improve the science behind high quality healthcare organisation and delivery. The SAPPHIRE group was awarded one of the Institute's first research commissions on the use of visual identification methods for people with dementia [**Tarrant, Armstrong**]. Staff collaborate extensively across UoL and externally, providing qualitative and social science expertise in large (£2M+) research programmes funded by the MRC, NIHR and ESRC. E.g., **Armstrong** and **Tarrant** are the implementation theme lead and deputy respectively for the NIHR-ARC-EM, **Armstrong** is a co-investigator on NIHR Programme Grants related to screening for atrial fibrillation led by University of Cambridge (SAFER Study; co-investigator **Sweeting** [Biostatistics]) and for peripheral arterial disease (PI Bown (UoA1), co-investigators **Gray & Yao** [Biostatistics]), and **Tarrant** is a co-investigator on two ESRC/RCUK funded studies on antibiotic use. The group leads a highly successful annual summer school on ethnography in healthcare improvement research attracting international attendees and its staff are recognised internationally through key roles in international think tanks and health strategy panels (see Section 4). In 2017, **Armstrong** was awarded one of the six national Improvement Science Fellowships by The Health Foundation further supporting research capacity in healthcare improvement.

The Centre for Environment, Health and Sustainability (CHES) was established in 2018 with £5M investment from UoL and philanthropic sources enabling Leicester to be at the forefront in tackling environmental health issues affecting human health and sustainability. The centre exemplifies our interdisciplinary approach bringing together over 15 groups across the university whose research spans environmental health, clinical research, epidemiology, genetics, respiratory sciences, environmental microbiology, geography and geology, the microbiome, health data science, and analytical chemistry. CHES links with the Natural Environment Research Council funded National Centre for Earth Observation (EO) and UK Space Agency funded Centre for EO Instrumentation. In its first two years, the Centre led or participated in interdisciplinary research grants totalling £20M (£4M to Leicester) from the NIHR, HDR-UK, EU Horizon 2020, BHF, Wellcome Trust and the UK Space Agency. In 2020, CHES received a £1M NIHR Health Protection Research Unit Development Award in partnership with Public Health England (PHE) and the Health & Safety Executive creating a pioneering national research centre.

The Infant Mortality and Morbidity Studies (TIMMS) group conducts high quality research and develops novel methodological approaches in the field of perinatal and paediatric epidemiology. The group lead the perinatal arm of the national MBRRACE-UK (Mothers and Babies: Reducing Risk through Audit and Confidential Enquiries) programme [**Draper, Manktelow, Smith**] and PICANet, the UK national Paediatric Intensive Care Database

[**Draper**]. These directly influence healthcare planning, policy, education and practice in reproductive, perinatal and paediatric medicine. The group lead the data harmonisation work package of a major EU funded international collaboration (RECAP-Preterm; EU Horizon 2020; €9.7M) [**Draper, Manktelow**, (Johnson UoA4)], developing innovative tools for data harmonisation to improve research utilising preterm birth cohorts across the EU and other high income countries. Staff in this group also contribute to the international Euro-Peristat network [**Smith**] establishing a high-quality, innovative and sustainable European perinatal information system spanning 31 countries to produce data and analysis on a regular basis. Euro-Peristat is instrumental in influencing decision-making about the health and care of pregnant women and newborns by national, European and international stakeholders. The group also collaborate with the University of Oxford on clinical trials in perinatal medicine and lead the NIHR-HTA funded [£1.65M] SURF-ON Trial, a multicentre, open-label RCT of surfactant therapy in late preterm and early term infants with respiratory distress [**Boyle**]. In 2018, £1M donation from LCFC enabled the strategic appointment of a Professor in Child Health [**Boyle**], the first UK Chair funded by a football club. Staff in this group make a significant contribution to healthcare policy through advisory roles in national and international organisations (Section 4).

Clinical staff in this theme are experts in the study of chronic kidney disease (CKD) [**Brunskill**], frailty in older patients [**Conroy**], child health [Gailard] diabetes and respiratory and cardiovascular disease [**Kadam, Khunti, Major, Pareek, Sayers, Seidu, Steiner, Webb, Zaccardi**] who conduct epidemiological and qualitative research in these patient groups. For example, Leicester is one of the largest contributors to the CKD Prognosis Consortium, the major international academic group using big data to report on risk factors for progression and outcomes in CKD. We also undertake research into care for frail, older people and lead the largest improvement collaborative in the world focusing upon frailty in acute hospitals across a range of disciplines [**Conroy**; ICS2].

#### Key achievements include:

- Publishing 723 papers (42.5 per FTE) cited 12,465 times, FWCI of 2.25. One quarter (26%) were in the top 10% most cited worldwide and over half (55%) in the top 10% of journals with 37% involving international collaborators.
- Providing evidence that long-term exposure to road traffic noise was associated with increased risks of all-cause mortality and cardiovascular mortality and morbidity in the general population, particularly for stroke in the elderly [**Hansell**; *EurHeartJ*;2017;FWCI5.97].
- Identifying older people at risk of frailty and adverse healthcare outcomes [**Conroy**; *Lancet*;2018;FWCI35.92], [**Holland**; *Lancet*;2018;FWCI21.3].
- Quantifying the variation in perinatal outcomes and the implementation of evidence-based practice across European neonatal services [**Manktelow**; *BMJ*;2016;FWCI12.32] [**Draper**; *Pediatrics*;2017;FWCI4.14].
- Key RCTs assessing interventions during labour [Field; *Lancet*;2017;FWCI8.17], neonatal care [**Boyle**; *NEJM* 2020;FWCI6.32] and in relation to Asthma [Wilson; *NEJM*;2018;14.86].
- Carrying out research that has **significantly improved the delivery of maternity and neonatal care** resulting in reduced stillbirth rates and improved outcomes for older people with frailty and acute care needs (ICS4).



**1.2.5 Tackling COVID-19**

The collaborative, interdisciplinary nature of our research is exemplified in our response to the COVID-19 pandemic. Leicester is one of the top three UK universities for COVID-19 research, being awarded £8.21M (£2M to UoA2 researchers) in government funding since the pandemic began. This demonstrates how our staff are able to capitalise on their interdisciplinary collaborations and our robust research infrastructure to mobilise swiftly to address emergent public health challenges.

Staff in this unit [**Wain; Khunti; Pareek; Armstrong**] are leading investigators of PHOSP-COVID (PI Brightling UoA1), a national research programme funded by £8.4M from UKRI/DHSC through the NIHR (£5.2M to Leicester) bringing together over 25 academic institutions, 53 hospitals and associated NHS trusts to understand and improve health outcomes following hospitalisation due to COVID-19, and a Novo Nordisk Health Care funded study to investigate the impact of COVID-19 lockdown on the lives of people with obesity [£210k: **Gillies** (PI), **Zaccardi**]. Our staff have also been pivotal in revealing the impact of COVID-19 on BAME communities reflecting our established strengths in this area. E.g., Staff lead the £2.1M UKRI/NIHR-funded UK Research study into Ethnicity And COVID-19 outcomes in Healthcare workers (UK-REACH) [**Pareek** (PI), **Khunti, Gray**]. They are also leading investigators of national surveillance programmes of the effect of COVID-19 on perinatal outcomes [**Draper**] and partners in international COVID-19 research e.g., co-investigators of a UKRI GCRF Block Grant Covid-19 Fund with South African MRC for a remote study on COVID-19 lockdown, vulnerability risk factors and air pollution among South Africans [**Hansell**] and a Royal Academy of Engineering GCRF Frontiers Follow-on Fund for a study of local and global Air Pollution data for Epidemiological research in collaboration with University of the Witwatersrand and South African MRC [**Hansell**].

Our staff hold national advisory roles including membership of the Scientific Advisory Group for Emergencies (SAGE) and Chair of SAGE COVID-19 Ethnicity Subgroup [**Khunti**]; membership of HDR-UK-UKRI-SAGE COVID Taskforce [**Abrams**]; membership of the College of Experts for NIHR and joint DHSC/UKRI COVID-19 funding calls [**Yao; Gray; Lambert; Khunti**]; Advisor to DHSC and PHE on COVID-19 and Ethnicity [**Khunti**]; provision of evidence on air pollution health impacts on COVID-19 for the House of Commons Environment Food and Rural Affairs Inquiry on Air Quality and the Quality Expert Group [**Hansell**].

**1.2.6 Future Research Strategy**

Over the coming years we will consolidate and build on our existing strengths in health and healthcare research and improvement, methodological innovation and data science, genetic, lifecourse and environmental epidemiology, and diabetes prevention and management to continue to realise our aim of improving population health and wellbeing. Aligned with both College and University strategies, this will encompass a focus on excellence in translational research influencing health and health policy and enhancing our interdisciplinary collaborations and clinical and industrial partnerships to optimise the economic and societal impact of our research. Specifically, we aim to:

- Reinforce and enhance our capacity in methodological research, both quantitative and qualitative, through focussed applications to key funders and by building on our successful translation of methods into practice through new and established links with health strategy panels and decision making bodies.

- Consolidate and expand our specialist centres to strengthen and nurture interdisciplinary research and further enhance Leicester's reputation as an international leader in genetic, environmental, and perinatal epidemiology and health services research to ensure translation of research into health policy and clinical impact.
- Strengthen research addressing health inequalities including expanding the capacity of the Centre for BAME Health and evolving our research strategy to address emergent public health priorities.
- Enhance our research capacity and train future research leaders through the development and expansion of our existing PhD training programmes and DTPs and by increasing ECR numbers through the provision of comprehensive support for fellowship applications.

### 1.3 SUPPORTING IMPACT

Staff are supported in maximising the impact of their research through robust infrastructure (Section 3) and guidance at an institutional, college and departmental level. In 2019, Leicester was awarded a £1M ESRC Impact Acceleration Account (IAA) to maximise and track the impact of our research and engage with patients, the public and third sectors. The fund was channelled into capacity building for impact activities through the provision of rapid response funding, training for PGR students and ECRs, and developing strategic partnerships with non-academic organisations. IAA funds are provided for staff to participate in the ESRC Festival of Social Science. For example, **Mackintosh** organised 'A window on the world of healthcare' understanding ethnography event attended by 50 students from sixth form colleges, undergraduates, patients and members of the public. Staff can apply for Impact Development Funding (IDF) to enhance and document the impact of their research. Staff in UoA2 [**Gray, Conroy, Manktelow**] received IDF which significantly enhanced the impact of their research (ICS2,3,4). Excellence in impact is recognised and valued through the University's Research Impact Awards and the annual Discovering Excellence Staff Awards which includes an award for Impact Champion. Links to industrial partners are supported through the College Enterprise Committee (see section 3).

## Section 2. People

### 2.1 OVERVIEW

Our staff and students are our primary asset and our success in achieving our aims is testament to their drive, commitment and ambition. We endeavour to attract and retain world class researchers by fostering an intellectually stimulating, inspiring and inclusive environment. Staff work within research groups across our four research themes. In each group a senior academic provides research leadership ensuring alignment within CLS and UoL strategy. Collaborations with colleagues across this and other UoAs are strongly encouraged. Support for staff and PGR development is described below, as well as our commitment to embedding the principles of equality, diversity and inclusion.

### 2.2 STAFFING STRATEGY AND STAFF DEVELOPMENT

Our mission is to recruit, retain and support staff in becoming leaders in their fields and in delivering research of the highest quality. In 2020, the University retained its HR Excellence in Research Award, recognising our continued commitment to researcher development and implementation of the principles of the Concordat to Support the Career Development of Researchers. A key element of this included introduction of the Leicester Academic Career

Map which exemplifies our long-term commitment to the Concordat through recognition of staff contributions and achievements in citizenship, engagement and enterprise, in addition to the core roles of research and teaching. Whilst a minimum of 40% contribution to research is expected for academic staff, the career map allows flexibility in the relative contributions and achievements in each domain recognising the different pathways to career progression.

Staff at all levels and across all professional groups are strongly supported in their personal development and career progression. Staff have an annual Performance Development Discussion (PDD) providing opportunities for positive and constructive two-way discussions with a senior colleague about individual performance and development needs. These discussions enable reflection and feedback on the previous year's contributions and achievements and set mutually agreed SMART objectives for the coming year, ensuring support needed to achieve these is in place. Discussions also address career aims, promotion, welfare and work-life balance. 'Appraiser training' is provided for staff who conduct PDDs and 'Appraisee training' is available for all staff to enable them to prepare and benefit maximally from these discussions. Our CLS staff surveys show a sustained increase in the number of staff having an annual PDD towards our goal of 100%.

Extensive training opportunities are available to all staff through internal courses and workshops. These are disseminated via dedicated webpages and highlighted in departmental communications. A training log is incorporated in the PDD to recognise training undertaken annually. Leadership training has been a strategic area of investment since 2015 leading to increased provision and uptake across a range of programmes. This includes the introduction of a Future Leaders Programme for senior academic staff in 2016, attended by 6 UoA2 staff (4 female) and a VITAL Leadership Programme for junior academic staff in begun in 2017, alongside training programmes offered by the Institute of Leadership and Management. Programmes focused on developing women as leaders include a new 'Women Leading with Purpose' programme from 2018, plus funding for attending the national Aurora Development Programme (which 6 of our Unit attended). A College mentoring scheme is available to all staff with mentors and mentees, receiving dedicated training. We stepped up the mentorship in 2019, establishing a 'Mentor Connect Scheme' College, which has doubled our pool of mentors to 95 across the CLS, so that ~30% of staff now have a mentor. The Leicester Coaching Academy was launched in 2018 to provide staff with opportunities for professional qualifications in coaching and to support the provision of coaching and mentoring to all staff.

UoL has policies for flexible working, special leave and an annual leave purchase scheme, alongside enhanced schemes for maternity, paternity, adoption, parental and compassionate leave (Institutional Environment Statement [IES], section 3.2). A Carer's conference and training fund is available providing up to £100 to support childcare costs incurred by attending events. A Wellcome Trust funded Institutional Strategic Support Fund (WTISF) Return to Research fund provides awards of up to £5,000 to support periods of protected research time for staff returning to work after ≥6 months leave to support their career development. The university has invested significantly in wellbeing including the appointment of an institutional Head of Health and Wellbeing and the initiation of range of new initiatives and policies, e.g., menopause, stress, mental health. All academic staff are entitled to take Study Leave once every seven semesters.

Through targeted recruitment of staff aligned to our strategic aims we have appointed established research leaders at professorial level across our four themes: (1) **Dudbridge** to Chair in Statistical Genetics to develop expertise in statistical methodology and computation

in genetic epidemiology; (2) **Yao** to Chair in Health Economics and lead for the Health Economics arm of the RDS-EM; (3) **Kadam** to Chair in Primary Care and Public Health Research; (4) **Hansell** to Chair in Environmental Epidemiology to establish and lead the CHES; and (5) **Boyle** to the LCFC funded Chair in Child Health. We have further developed our alignment with local NHS partner organisations through the transfer of world-leading clinicians to UoL contracts to support our strategic aims, including Chairs in Geriatric Medicine [**Conroy**], Respiratory Medicine [**Steiner**] and Vascular Surgery [**Sayers**].

We have invested in developing future research capacity through strategic appointments at Associate Professor level [**Sweeting, Mackintosh**] and new lectureships [**Guyatt, Rutherford, Crowther, Major, Owen, Gillies**]. Our commitment to supporting career development led to the promotion of seven staff to Chair (six female) and nine to Associate Professor (six female) in this unit. In total, 25% of returned staff were promoted during the assessment period.

### 2.3 EARLY CAREER RESEARCHERS (ECRs)

Development and retention of ECRs is fundamental to our research strategy. We include seven ECRs in this submission, of which four are Academic Clinical Lecturers (ACLs). We actively support all ECRs on their trajectory to research independence as demonstrated by numerous research fellowships awarded over the assessment period. These include NIHR (15) and MRC (4) fellowships as well Kidney Research, The Health Foundation, Wellcome Trust, Foundation for the Sociology of Health & Illness, Action for Pulmonary Fibrosis and Asthma UK.



**Figure 2.** Support for research staff and ECRs across CLS.

Figure 2 shows the range of support we offer research staff (RS) and ECRs. The CLS Early Career Researcher & Research Staff Development Group (ECR-RS-DG) was established to develop and coordinate support for the personal and professional development of RS/ECRs. The group provides a forum for RS/ECRs to input to College management structure and strategy and supports implementation of the Concordat and wider EDI initiatives. Each department has a Research Staff Advisor who liaises between the ECR-RS-DG and



RS/ECRs. The ECR-RS-DG facilitated the development and implementation of several successful initiatives including Mentor Connect, the CLS mentoring Scheme for RS/ECRs, and the development of a Postdoc and Research Staff Association (PDRSA) in 2018. The PDRSA helps develop a sense of community and provides peer support for RS/ECRs across the College with monthly seminars, researcher-focussed training sessions and social events, including an inaugural symposium attended by ~90 RS/ECRs in 2019, funded by the MRC Industry Academia Exchange (IAX) Fund, the WTISF. This enabling the PDRSA to offer leadership training and invite external speakers from industry and third sector organisations. The PDRSA feeds back into shaping the agenda and provision of support for RS/ECRs through representation on CLS College committees (Figure 2). The group also works closely with the CLS Athena Swan Self-Assessment team and are members of UoL's Responsible Use of Metrics Task and Finish Group. Feedback from the recent HR Excellence in Research Award review report stated that the PDRSA was 'a great asset to the institution in terms of researcher representation and community building.'

Comprehensive training programmes for RS/ECRs are available through the Doctoral College (DC) and the Leicester Learning Institute, and a DC Research Staff Fund provides financial support for travel, research support or bridging funds. An institutional Researcher Leadership Programme was introduced in 2019 to mirror the training provided for academic staff and RS/ECRs are encouraged to join committees at university and college level, with training and support to initially shadow staff on committees. RS/ECRs are also encouraged to gain experience in acquiring and running funded projects or public engagement events through the provision of support in applying for small external grants or internal funding awards (e.g., from the LPMI, ECRS IAA of WTISF or through pump-priming grants within departments). They have opportunities to gain experience in working with industry through the Accelerating Business Collaboration Training Programme or engagement with the Leicester Innovation Hub. Support in developing open sciences practices is also available via our UK Reproducibility Network Lead in Leicester and there is an active ReproducibiliTea Journal Club. RS/ECRs are also encouraged and supported in undertaking teaching opportunities and to attain Higher Education Academy fellowships to enhance their future academic career opportunities. Activities and achievements are celebrated at Departmental conferences and newsletters and rewarded through merit awards.

Evidence of our success in mentoring ECRs to positions of leadership include **Wain** appointed as Research Associate in 2007, promoted to Lecturer in 2011, Associate Professor in 2015 and Professor in 2017, the latter via a competitive British Lung Foundation Chair in Respiratory Research. Similarly, **Gray** was appointed as Lecturer in 2011 then promoted to Senior Lecturer in 2014, Reader in 2016 and Professor in 2018. **Rutherford**, **Crowther** and **Owen** all studied for PhDs in Leicester and have progressed to lecturer and then Associate Professor.

Our support for RS/ECRs is reflected in recognition of their research excellence at a national and international level. Examples of awards to ECRs in our unit include: outstanding oral presentation by a post-doctoral fellow at the International Genetic Epidemiology Society [Melbourne]; British Science Association's Margaret Mead Award Lecture for Social Science [Williams]; best oral presentation at the UK Continence Society meeting [Owen]; Reviewers' Choice abstract at the American Society of Human Genetics Meeting [Guyatt]; European Renal Association Congress Outstanding Scientific Presentation and Canadian Society of Nephrology Top Honour Abstract [Major]; Invited editorial in the American Journal of Respiratory and Critical Care Medicine [Allen]. Our ECRs are also invited to deliver specialist



training sessions for NICE and have attained funding (€115k) for the organisation of 3 EMBO Practical Courses on Population Genomics and one EMBO Conference Series on Human Evolution in the Genomic Era, and some hold visiting positions including at Spaienza University of Rome and Karolinska Institutet.

## 2.4 POSTGRADUATE RESEARCH STUDENTS (PGR)

PGR students are fully integrated into the culture of research groups and departments with access to a Postgraduate Research Tutor and Postgraduate Research Administrator. Support is provided institutionally by the DC, which also supports ECRs and promotes a seamless career pathway. Working closely with departments, the DC manages recruitment, admissions, induction, research and personal development training, probation reviews and examinations. Generic and specialist training is offered with numerous opportunities for students to showcase their research, engage with the public, and network with others. These include Pint of Science and PubPhD; Cafe Research; three-minute thesis presentations; Doctoral inaugural lectures; the annual Images of Research exhibition; and the Festival of Postgraduate Research, where a group of the University's best students, selected competitively, present their research to academics, employers, and the public. The Careers Development office also provides advice for students on career planning, preparing job applications, personal development planning, as well as hosting specialist career events in and outside of academia. We provide strong support for international students via the English Language Training Unit before and during their studies.

Within CLS there is specific training in research skills with opportunities for PGRs students to present their work at the annual CLS Life Sciences Poster Fair, together with annual prizes for PhD/MD students including public Doctoral Inaugural lectures. Inspirational career talks by leading academics are key components of this experience. PGRs have an increased offer for health and wellbeing, including access to both student and staff provisions, a range of 24-hour counselling and supporting services and a series of proactive sessions (Mental Health First Aid Training, Stress Management, Resilience). Our 2018-19 PRES data are very favourable, with extremely positive student ratings across the board, with particularly high ratings for satisfaction with supervision, provision of resources, professional development, and overall satisfaction (e.g., 91.4% in Health Sciences). PGRs in our unit are strongly encouraged and supported in applying for externally funded studentships (e.g. NIHR, MRC). The WTISF provides short term (1-2 year) Fellowships to enhance ECRs competitiveness for externally-funded fellowships. They also contribute significantly to our publications with 20 PhD and MD students (24%) co-authoring our submitted papers; 8 as first author including **Allen** identifying genetic variants associated with Idiopathic pulmonary fibrosis (*Lancet Respiratory Medicine*;2017;FWCI8.21); **Owen** developing methodological work for network meta-analysis (*Value in Health*;2015;FWCI2.59); **Booth** developed temporal recalibration methods to improve relevance of prognostic models (*International Journal of Epidemiology*;2020).

Students have support from high-profile DTPs in areas with national skill shortages (e.g. genomic analysis, biostatistics, epidemiology, data science, bioinformatics, public health) including;

- Wellcome Trust DTP in Genomic Epidemiology and Public Health Genomics [Theme Leads: **Armstrong, Dudbridge, Wain**, £5.15M]; supporting 40 students over 5 annual intakes (15 supported through matched UoL funding). The DTP includes strategic training partnerships with GSK, AZ, Genentech, Pfizer and several LMIC institutions

(University of Cape Town, South Africa; University of the Witwatersrand, South Africa, Centre for Cellular and Molecular Biology, Hyderabad, India; University of Sao Paulo Medical School, Brazil).

- MRC IMPACT (Integrated Midlands Partnership for Biomedical Training) [Lead: **Wain**] supporting 14 studentships/year across the Universities of Leicester, Birmingham and Nottingham; **total £3.5M** with matched contribution from each institution, focussing on projects in complex diseases.
- The BHF 4-year PhD programme in interdisciplinary cardiovascular research linked with UHL (£1.64M) supporting 5 students/year (2 from CLS matched funding).
- ESRC Midlands Graduate School DTP [**Mackintosh** Health & Wellbeing Pathway lead].

To increase their specialist skillset PGR/ECRs can participate in relevant modules on Masters courses, including MSc Medical Statistics, MSc Diabetes, MSC Bioinformatics, and MRes Applied Health Research.

We have increased the number of students successfully completing their doctoral studies from 31 in REF2014 to 82 in this assessment (72 PhD, 10 MD). In addition to DTP funded studentships our current students are supported through funders that include MRC, NIHR and HDR-UK. The quality of our doctoral students is reflected through first work destinations which include Karolinska Institutet, Max Planck Institute, University of Melbourne, University of Warwick and GSK. A strategic goal of all our research themes is to continue to increase our PGR community through externally funded studentships/fellowships (Section 1). PGR students are strongly encouraged to present at national and international conferences and public engagement events and to gain additional experience through success in competitive research internships with external organisations (e.g., The Turing Institute, Roche UK, Roche Basel and Swiss Precision Diagnostics) or research visits to other institutions (e.g., Karolinska Institutet).

We support and develop NIHR Academic Clinical Fellows and Lecturers [**Major, Papamargaritis, Williams, Seidu**]. In 2018 we established a grant development forum for academic clinical fellowships and clinical lecturers in conjunction with the Leicester BRC to identify grant and fellowship opportunities with support of senior and junior investigators.

## 2.5 EQUALITY, DIVERSITY AND INCLUSION (EDI)

We place great importance on EDI (IES, 3.1) and are proud of our 53% BAME student body (sector average 18%). Of those completing PGR studies within this UoA, 56% are female and 50% BAME. Of all staff submitted to this unit, 43% are female and 11% BAME; of the 24 professorial staff, 46% are female and 12.5% BAME. We have a university-wide culture of inclusion incorporating all aspects of our activity with EDI embedded at the heart of the University's Strategic Plan. This is reflected in a new robust governance structure for EDI and is central to the vision of our new Vice-Chancellor, Nishan Canagarajah (appointed 2019), who has taken on the role of EDI lead for the University.

Leicester has an Equality and Diversity Committee and Equality Action Groups for each of the protected characteristics with Diversity Champions in every department. There is mandatory staff training in EDI and in challenging unconscious bias: all staff complete online modules at induction with follow up at regular intervals as part of the PDD process. We have seen increasing uptake of EDI training from 60% in 2016 to 87% in 2019. There is additional

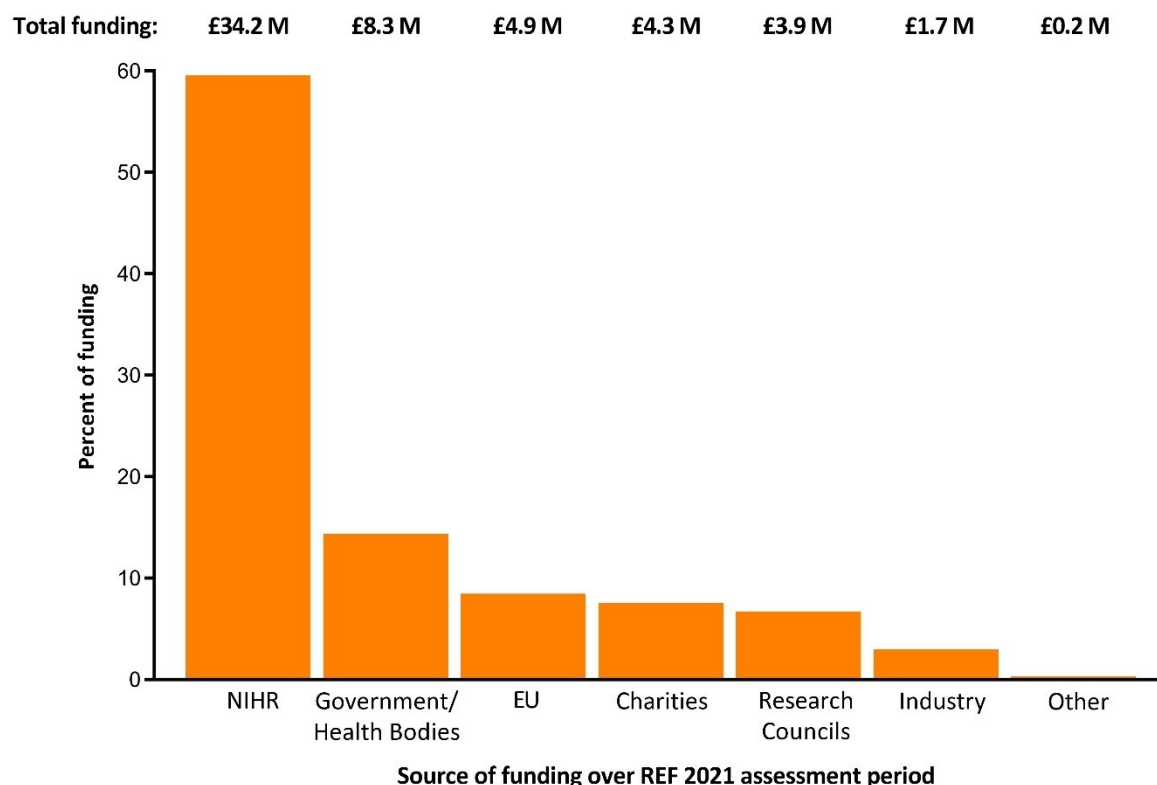
staff training at departmental events, e.g. unconscious bias seminars at departmental staff conferences.

Our commitment to EDI is recognised externally where UoL is a Stonewall Diversity Champion and a top 50 employer in Stonewall's Workplace Equality Index. UoL is a Race Equality Charter signatory and was one of 10 universities worldwide to be part of the United Nation's HeForShe, a global solidarity campaign for gender equality. In 2020, CLS gained a Silver Award replacing five silver and two bronze departmental awards. There was substantial contribution from staff within this UoA e.g., **Armstrong** led a project on pathways to progression for academic and research staff which was highlighted within the Athena SWAN feedback. Staff contributions to improving EDI are recognised and celebrated through the University's annual Discovering Excellence Awards which includes an Equalities Champion award. We have an annual celebration of Black History month and we are national leaders in ethnicity-focussed research through the Centre for BME Health (Section 1).

### Section 3. Income, infrastructure and facilities

#### 3.1 RESEARCH INCOME

Our research is underpinned by diverse range of external funding, which spans both national and international sources, and fosters the breadth, quality and sustainability of our research. Over the assessment period we were awarded a total of £57.4M (£1.35M per FTE), a 70% increase from REF2014. NIHR is our key funding source (£34.3M including income in kind), with government bodies, EU, MRC, HDR-UK, industrial, philanthropic and charitable organisation funding comprising the rest.



**Figure 3.** Amount and source of funding over the REF2021 period.

Examples of Key NIHR funding includes NIHR-ARC-EM and NIHR RDS (East Midlands and National Office) and 25 NIHR fellowships (11 pre-doctoral/Research Methods, 7 doctoral, 6 advanced and 1 development and skills enhancement). Our MRC funding includes 5 Methodology Research Panel grants. The George Davies Foundation (£5.2M) supported a Chair in Vascular Surgery [**Sayers**] and associated research programmes to investigate multi-morbidity in frail older people with peripheral vascular disease and at risk of amputation.

### 3.2 INFRASTRUCTURE AND FACILITIES

Major investment in the physical environment and research infrastructure has significantly developed our capacity and enhanced our portfolio of collaborative interdisciplinary research.

Investment in the physical environment includes the **£42M George Davies Centre for Medicine** in 2016, the largest capital investment in medical teaching and applied research by any UK university in the last decade. The building houses the majority of staff in UoA2 and includes 12,836m<sup>2</sup> of offices and support spaces for over 2,350 staff and students. This brought together health research, medical education and psychology under one roof leading to new research structures that enhanced team science and collaboration between research themes and departments.

The **Diabetes Research Centre (DRC)**, located in Leicester General Hospital, is one of the largest facilities in Europe for conducting clinical research and provides over 4,500m<sup>2</sup> of refurbished research space for over 150 university and NHS staff. It supports research with clinical populations and houses core infrastructure including the NIHR-ARC-EM, Centre for BAME Health and the Leicester Real World Evidence Unit.

The **Centre for BAME Health**, developed as part of the previous **NIHR-CLAHRC** East Midlands and supported via the current **NIHR-ARC-EM**, brings together expertise, experience and knowledge of ethnicity in research, health and social care thereby developing a centralised resource to support individuals and organisations undertaking research in partnership with BAME communities. The importance of the Centre is demonstrated with the award of funding to study the links between COVID-19 and ethnicity [**Pareek, Khunti, Gray**] and it played a key role during the pandemic helping national NIHR studies recruit ethnic minority participants, including to vaccine trials.

The launch of the **Real World Evidence Unit** was enabled by start-up funding of £500k from UoL and £1.3M from industrial partners (Astra Zeneca, Boehringer Ingelheim, Sanofi, Merck, Servier, NOVO Nordisk). It consolidated growing expertise in routinely collected patient/service user data and hosts our Multi-Study Licence for the Clinical Practice Research Datalink (CPRD), linked with Hospital Episode Statistics and mortality data from the Office for National Statistics, which are incorporated in numerous research projects in our unit. Further investment in bioinformatics and biostatistics has been provided through the CLS funded **Bioinformatics and Biostatistics Support Hub (BBASH)** and the **HDR-UK Midlands site**.

The **NIHR Biomedical Research Centre (BRC)**, established with a £11.6M investment from the NIHR in 2017, enables pioneering research into medical advancements and provides a collaborative workspace within UHL NHS Trust. The BRC is at the forefront of research into illnesses linked to respiratory conditions [**Steiner, Wain**], cardiovascular disease [**Nelson, Sayers**] including chronic kidney disease [**Brunskill, Major**], cardio-metabolic diseases and lifestyle [**Dunkley, Gray, Kadam, Khunti, Webb, Zaccardi**].

Established links with primary, secondary and tertiary care present significant research capacity complementing areas of research excellence within the University and our unit. We are partners with UHL NHS Trust, the largest acute trust in the UK treating over 1M patients annually and the only trust in Leicestershire and Rutland providing a large, stable, secondary care population (2.5M). We also undertake research across all 6 of the other hospital Trusts in the East Midlands. Our collaboration with the NHS has been further strengthened through recent development of **Leicester Academic Health Partners (LAHP)** to further integrate clinical research between UoL and the local NHS trusts to accelerate and integrating research within healthcare delivery to improve the health and wellbeing of our local communities. We have strong links with primary care partners that enable out diabetes and lifestyle researchers to conduct both discovery and implementation research in the wider population.

Other key infrastructure supporting UoA2 researchers (Figure 1) includes:

The **NIHR Research Design Service for the East Midlands (RDS-EM)** supports researchers across multiple UoAs and throughout the region in designing and developing high quality research proposals for national, peer-reviewed funding competitions. It supports over 200 new projects annually with a success rate of 66% and annual grant funding of over £23M per year. The RDS-EM contract was renewed for 2018-2023 (£2.5M to UoL) and now **hosts the NIHR RDS National Office** (£0.6M) setting the strategic direction for the RDS as a national service.

The **Leicester Precision Medicine Institute (LPMI; IES, 2.2)** links research at UoL, UHL and industry and was initiated as part of a 5-year UoL strategy (from 2015) to increase research excellence and impact through the establishment of five interdisciplinary research institutes and supporting collaborative research with industry.

The **Leicester Institute for Advanced Studies (IES, 2.2)** initiates cross-cutting research by pump-priming interdisciplinary projects and teams, bringing external experts for research collaborations through visiting fellowships, providing workspaces for training and workshops, and facilitating the development of networks and strategic partnerships.

The **BHF Research Accelerator for Precision Medicine** (£1M) supports research in biomarker discovery, genomics, imaging, new cardiovascular interventions, stroke medicine and vascular surgery.

Internal support for funding applications is provided by a central **Research and Enterprise Division (RED)** (IES, 4.1). The RED Pre-Awards Team provides advanced notification of funding calls, support in preparing applications and interacting with funders, peer reviews applications, and facilitates grant development meetings. Academic-led Key Funder Working Groups provide support for specific funding streams. Support in costing applications is provided by departmental finance teams and the RED Contracts Team provide support for commercial contracts and consultancies. Strategic partnerships with the Life Sciences Industry are developed through the EU funded (£2.5M) Leicester Innovation Hub (IES, 2.5), which houses the Leicester Life Sciences Accelerator linking businesses to academics and clinicians to support the development of new products and ideas.



UoL provides a range of **internal funding schemes** to support staff to develop and deliver research, with a particular focus on interdisciplinary collaboration and team science. These include the WTISF (£1.5M, 2017-2021) with matched internal funding (8 grants awarded to staff in this UoA) to support fellowships for ECRs, and projects facilitating public engagement. Staff can apply for Research Equipment and Infrastructure Funding for purchase of core equipment and software to develop research capabilities and for MRC Confidence in Concept funding (up to £80,000 per award) supporting projects accelerating development of medicines, therapies, diagnostic tests and devices with real-world benefits for patients. Since 2017, funding of up to £5,000, managed through LIAS, has been available to establish interdisciplinary 'Tiger teams' to enable collaboration on focused tasks to stimulate innovative, transformative research. Awards made to four staff in this unit [**Conroy; Pareek; Khunti; Mackintosh**] have significantly enhanced external collaborations and funding. For example, funding to advance the use of digital technology for maternity care [**Mackintosh**] contributed to the development of a UK-India multi-agency interdisciplinary network leading to external funding awards totalling £268,000 from the Foundation for the Sociology of Health and Illness, AHRC/MRC, GCRF and SANDS, the UK's leading stillbirth and neonatal charity.

Leicester is committed to driving forward and delivering development-related, challenge-led research. The Leicester Global Challenges Research Fund strategy was highly commended by Research England for clearly and correctly placing the developing countries specified as prime beneficiaries with appropriate emphasis on administration. The commendation also refers to Leicester's own Theory of Change in delivering and evaluating impact.

The **University Library Services** (IES, 4.2) provides support for all researchers, including advanced literature searching and reference management. They further support us in embedding a culture of **open research** by, for example, facilitating open access publishing, research data management, citation analysis, creating digital collections, data repository, and sharing through institutional open-access infrastructures (e.g. Figshare). In 2020 the College of Life Sciences FigShare saw a monthly average of >40K views and >28K downloads. In addition to ensuring our publications comply with REF open access requirements and institutional policy (IES, 2.6), we have made codes, preprints, protocols, conference papers openly accessible. During the assessment period, 80% of our outputs were published open access, compared to the Russell Group average of 63% (SciVal).

UoL has invested in a powerful **High-Performance Computing** (IES, 4.3) service via a £2M Capital Infrastructure Fund award. This service supports some of the largest worldwide genetic epidemiology studies led by Leicester and is essential for research undertaken by staff within the Biostatistics and Genetic Epidemiology themes. HPC services are available to all academic staff and PGRs for complex modelling, simulation, data processing and analysis and are training and support are provided by a dedicated team.

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

We place a high value on research collaboration and partnerships, enabling us to learn from and input to local, national and international research communities, health policy and services. Our diverse range of collaborations with academic institutions, the public sector, patient groups and industry reflects both our position and our renown.

**4.1 Collaboration with and contribution to health and care organisations:**

Our research contributes to, and is closely integrated with, the NHS, PHE and other health and care organisations. We have longstanding partnerships with UHL NHS Trust, other regional NHS providers, and regional Clinical Commissioning Groups. E.g., NIHR-ARC-EM involves collaboration with over 80 providers of NHS and care services, patient groups, commissioners, local authorities, universities, industry and charities across the East Midlands enabling us to develop research that meets the needs of our local population. Our collaboration with the NHS is further strengthened via the LAHP together with the LPMI and the BRC.

We make significant contributions to national collaborations in the fields of health data research and NHS quality improvement, e.g., to HDR-UK Midlands [**Abrams; Brookes** - Associate Director] with the Universities of Warwick, Birmingham, Nottingham, and as partners in The Healthcare Improvement Studies (THIS) Institute [**Armstrong; Tarrant; Mackintosh**]. Staff in our unit also work in collaboration with PHE or have significant positions therein, e.g., **Hansell** and **Sweeting** hold honorary PHE positions; **Hansell** is a member of PHE's Environmental Health Programme Board; **Lambert** and **Rutherford** provide methodological support to PHE's analysis team and are members of PHE's Cancer Statistics Advisory Panel; and **Draper** is a member of PHE's Scientific Advisory Group for National Congenital Anomaly and Rare Disease Registration Service.

Leicester is one of the most ethnically diverse cities in the UK, making us ideally placed to address issues affecting the health of ethnic and migrant communities. The Centre for BAME Health facilitates and leads collaborative research to address inequalities in health care access and health outcomes by supporting individuals and organisations in planning and undertaking research by working together with patients, the public, community and voluntary sectors, researchers, and health & social organisations.

**4.2 Contribution to national and international health strategy and policy:**

Almost one quarter (22%) of our staff are the Chair or a member of health strategy panels that impact on health and wellbeing, care and policy across the lifespan impacting. E.g.: 18% of staff provide methodological expertise to, or are members of, NICE committees including NICE's Public Health Advisory Committee [**Yao**]; Medical Technologies Advisory Committee [**Brunskill**]; Diagnostic Advisory Committee [**Abrams**]; Decision Support Unit [**Bujkiewicz**]; Technology Appraisal Committees [**Abrams; Owen; Steiner**] and Guideline and Quality Standards Committees [**Gaillard; Khunti**].

Other examples of health strategy panel membership include:

- **NHS/DHSC/MHRA panels:** NHSE Clinical Reference Group for Vascular Surgery [Chair: **Sayers**]; Child Health Specification Development Group [**Draper**]; NHS Five Year Forward View Maternity Review Quality Steering Committee [**Draper**]; Independent Advisory Group for Each Baby Counts, Royal College of Obstetrics and Gynaecology; NHSE Diabetes Prevention Expert Reference Group [**Khunti**]; NHSE Overprescribing Working Group [**Armstrong**]; UK National Screening Committee Adult Reference Group [**Armstrong**]; DHSC Pregnancy Loss Review Steering Group [**Smith**]; MHRA Expert Advisory Group for optimising data on the safety of medicines in pregnancy [**Draper**].
- **UK Clinical Studies Groups:** Neonatal Clinical Studies Group [Chair: **Boyle; Smith**]; UK National Kidney Research Consortium, Chronic Kidney Disease Clinical Study Group

[Co-Chair: **Brunskill**]; Stillbirth Clinical Studies Group [**Smith**]; Diabetes UK Clinical Studies Group for Prevention, Targets and Therapies for Type 2 Diabetes [**Gray**].

- **Environmental health panels:** Committee on Aviation Environmental Protection Impacts and Science Group and the Government Committee on Medical Effects of Air Pollution [**Hansell**].
- **Clinical Audit & Improvement:** British Isles Network of Congenital Anomalies Registers [Chair; **Draper**]; Healthcare Quality Improvement Partnership Methodology Group [**Draper**, **Manktelow**]; National Maternal and Perinatal Audit Advisory Group [**Draper**]; Pulmonary Rehabilitation component of the National COPD Audit [Clinical lead: **Steiner**]; British Thoracic Society Quality Improvement Committee [Chair: **Steiner**]; Vice-Chair of the Quality Improvement Section of the Royal Statistical Society [**Manktelow**].

#### **4.3 Contribution to national and international research capacity and community**

Our staff make substantial contributions to research capacity and leadership in the UK and internationally. For example, our staff hold positions as:

- **Fellow of the Academy of Medical Sciences** [**Khunti**].
- **NIHR Senior Investigator** [**Khunti**] & **NIHR Senior Investigator Emeritus** [**Abrams**; **Baker**].
- **27% of our staff hold positions on NIHR funding panels**, including Health Technology Assessment [**Conroy**]; Research for Patient Benefit [**Gray**, **Gillies**, **Mackintosh**, **Armstrong**]; Health Services & Delivery Research [**Kadam**, **Khunti**]; Programme Grants for Applied Health Research [**Tarrant**, **Gray**], Interventional Procedures Panel [**Sayers**] and a range of fellowship panels [**Gray**, **Kadam**, **Abrams**, **Cooper**, **Armstrong**].
- **27% of our staff hold positions on other health related funding panels** including the Wellcome Trust [**Wain**, **Dudbridge**, **Hansell**]; MRC [**Abrams**]; Asthma UK [**Wain**]; Diabetes UK [**Khunti**]; Cancer Research UK [**Lambert**]; Pharmacy Research UK [**Holland**]; SANDS stillbirth charity [**Mackintosh**]; Norwegian Cancer Society [**Lambert**]; Swedish Research Council [**Armstrong**]; and Qatar National Research Fund [**Zacchardi**].
- **7 staff are Chair or members of Trial/Study Steering Committees and Data Monitoring and Ethics Committees** [**Abrams**, **Bujkiewicz**, **Cooper**, **Holland**, **Sheehan**, **Steiner**, **Wain**].
- **22% hold editorial board positions**, of which 13 (1/3 of all staff) are **Editors or Associate Editors**. These span a wide range of disciplines reflecting the interdisciplinary nature of our unit, including journals in Maternal and Child Health, Respiratory Science and Medicine, Diabetes, Statistics, Bioinformatics, Genetics, Environmental Health, Quality and Safety, Age and Ageing and General Medicine.
- **1 in 5 staff hold visiting positions** including Karolinska Institute [**Lambert**, **Crowther**, **Lawson**]; University of Linköping, Sweden [**Lawson**]; University of Siena, Italy [**Kadam**]; WHO International Agency for Research on Cancer [**Rutherford**]; University of Melbourne, Australia [**Khunti**], University of Cambridge [**Sweeting**, **Dudbridge**]; and Imperial College London [**Hansell**].
- **10 staff have held honorary positions** including Honorary Chairs at the Universities of York [**Abrams**] and Bristol [**Dudbridge**]; others honorary positions including at the Department of Infectious Disease Epidemiology, Imperial College London [**Baggaley**]; University of Cambridge [**Dudbridge**], UCL [**Dudbridge**, **Williams**], University of Bristol [**Wain**]; Health Sciences Research Institute, University of Warwick [**Armstrong**].
- **40% of our staff provide expertise to Scientific Advisory Panels or Working Groups** across a range of disciplines and organisations both in the UK and internationally.

Examples of international appointments include: DISCOVER Scientific Committee [Chair: **Khunti**]; United Nations Inter-Agency Group for Child Mortality Estimation [**Smith**]; International Stillbirth Alliance's harmonisation of perinatal death classification study group [**Draper**]; Australian National Centre on Stillbirth [**Draper**]; International Cancer Benchmarking Partnership [**Lambert, Rutherford**]; American Thoracic Society Pulmonary Rehabilitation Assembly Executive [**Steiner**]; Canadian Institute for Health Information [**Conroy**]; Australian National Health and Medical Research Council Centre of Research Excellence, the Centre for Air Pollution, Energy and Health Research [**Hansell**]; Governing Board of European Joint Programme for Rare Disease [**Brookes**]; Scientific Reference Group for the Hazelwood Mine Fire Health Study, Australian Government Department of Health and Human Services [**Hansell**]; European Union of Geriatric Medicine Society, emergency care of older people special interest group [Chair: **Conroy**].

- Our staff also hold **senior leadership positions in professional societies**, e.g., President of the Vascular Society of Great Britain and Ireland and Chair of the Vascular Society research Committee [**Sayers**]; Chair of the International Society for Evidence Based Neonatology [**Boyle**]; Chair of the American Thoracic Society Pulmonary Rehabilitation Assembly Programme Committee [**Steiner**]; Chair of the British Thoracic Society Quality Improvement committee [**Steiner**]; Board member of the International Genetic Epidemiology Society [**Dudbridge**]; Chair of the National Kidney research Consortium [**Brunskill**]; Vice President of Human Genome Variation Society [**Brookes**].

#### Awards and recognition:

In addition to the prestigious national and international awards received by our ECRs (see Section 2.3), our contribution to the research base, economy and society is further recognised through a number of prestigious awards made to our academic staff throughout the REF period, e.g.:

The LDC's Effective Diabetes Education Now (EDEN) project, a wide-scale education and transformation programme to address skill gaps and change models of care in diabetes knowledge in healthcare professionals established in 2012, received the Healthcare Professional or Patient Engagement Programme of the Year Award in the inaugural Diabetes Professional Care Industry Awards in 2018 [**Khunti**]. The Leicester Changing Cities Programme was also highly commended as a Diabetes Prevention Product of the Year in the same awards. More broadly, **Khunti** was named in the top 10 Diabetes researchers in the world in 2015 and 2018 and one of the top 2 Most influential Diabetes Researchers Globally by Expertscape. He was also awarded the British Association of Physicians of Indian Origin Lifetime Achievement Award and the BMJ Diabetes Team of the Year for the South Asian Health Foundation Programme, and was named as one of the 'Nation's Lifesavers' top 100 individuals or groups whose work in HEIs is saving lives and making a difference to our health and wellbeing.

**Conroy** won the 2019 Royal College of Physicians' The Lancet Research Award, the 2018 Worshipful Society of Apothecaries' William Farr Medal and the 2018 Royal College of Physicians' Excellence in Patient Care Award for quality improvement in relation to the care of frail, older people.

**Lawson** was awarded the 2015 American College of Epidemiology Research Excellence Award, the 2020 Circulation: Heart Failure Paper of the Year, and the 2020 American Heart Association's Emerging Investigator Award.

In 2019, **Draper** was awarded honorary membership of the British Association of Perinatal Medicine in recognition of her contribution to research and perinatal care improvement, and Fellow ad eundem of the Royal College of Obstetrics and Gynaecology for scientific advancement and achievement in women's healthcare.

**Wain** was awarded the Hypertension Journal best basic science paper of 2018 and was invited to review research on translational genomics and precision medicine for the journal Science (2019).

#### **4.4 Collaboration and partnerships with industry:**

Our researchers have many long-established industry collaborations including research informing drug discovery and development. These range from CASE studentships with GSK to strategic collaborations between the Universities of Leicester and Nottingham and Pfizer and GSK. GSK fund the Respiratory Genetic Collaboration [**Wain**], contributing to regional strengths in delivering the UK's Life Sciences Industrial Strategy. We have strategic collaborations with in-kind contributions leading to major scientific outputs with Amgen, Genentech and Regeneron [**Wain**; *Nat Genet*; 2017] [**Wain**; *AJRCCM*; 2020]. Our staff provide expert guidance on statistical methods developed in Leicester with over 17 international pharmaceutical companies (ICS1).