| Institution: King's College London |
| --- |

Unit of Assessment: 2

1. Unit context and structure, research and impact strategy
1.1 Context and Structure
King's College London (**King's**) is a multi-faculty university that Unit of Assessment (**UOA2**) draws upon to provide a critical link between health researchers in the **Faculty of Life Sciences and Medicine** (**FoLSM**), other Faculties across King's, and colleagues in our Academic Health Science Centre, **King's Health Partners** (**KHP**).

UOA2 comprises **38.85 FTE** researchers, who generated **£55M of research income** since REF2014, including £37.9M from National Institute for Health Research (NIHR) and other UK research funders, averaging £1.41M/FTE, with **85 PhD studentships** awarded.
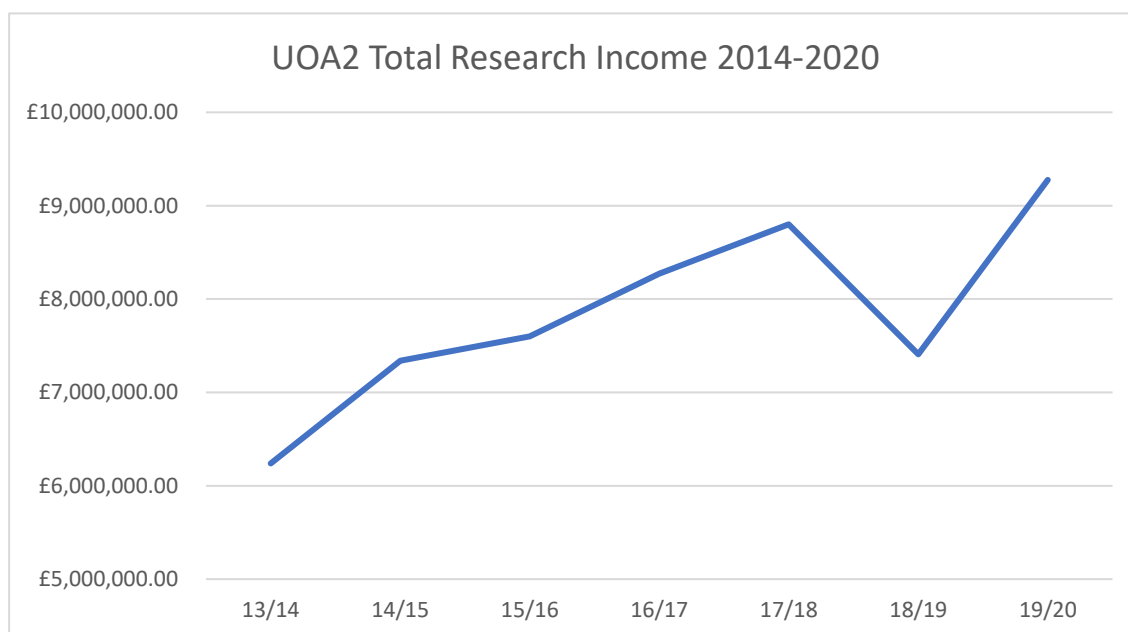
Figure 1: Research Income

UOA2's mission is **to improve the health and wellbeing, care and outcomes for individuals and populations locally and globally** through transformative research, education, knowledge exchange and innovation. We embed research in some of the UK's most deprived communities, as well as in global networks in low- and middle- income countries (LMICs). The focus is on air quality, long term conditions, electronic health record research, clinical trials and other forms of evaluation.

UOA2 researchers are predominantly located in the **School of Population Health & Environmental Sciences (SPHES)** in FoLSM. Created in 2017, it enhances the importance of population health, with two Departments *Population Health Sciences* and *Analytical, Environmental and Forensic Sciences* (mostly returned in REF2014 UOA2). UOA2 includes researchers from **King's Policy Institute (Faculty of Social Science and Public Policy)** and the **Institute of Psychiatry, Psychology and Neuroscience (IOPPN)** facilitating implementation science and impact agendas, and with whom there are active collaborations and PhD supervision.

Figure 2: Components and networks of King's UOA2.

UOA2 has selected 91 of 1,582 eligible papers. 119 (8%) in top 1%, 268 (17%) top 5%, and 415 (26%), top 10% of subject-weighted citation scores (Source: SciVal Dec 2020). Top-tier journals with multiple publications include: Lancet journals (95), BMJ (23), PLOS Medicine (12), New England Journal of Medicine (4), Nature Journals (4), NIHR journals (18); Specialist journals: Stroke (16), Cochrane Database of Systematic Reviews (35), Trials (31), Age and Ageing (14), Health Expectations (11), Social Science and Medicine (8).

1.2 UOA2's response to COVID-19:
- Prioritising and pump-priming research locally and nationally (with NIHR Clinical Research Network (CRN)) for vaccine trials, acute and long-term care (**Wolfe,** R&D Director)
- Clinical Practice Research Datalink (CPRD) analyses of COVID-19 and antihypertensive medication and antimicrobial stewardship (**Gulliford**)
- Sentinel Stroke National Audit Programme (SSNAP) analyses of quality of care (**Douiri**)
- Developing COVID-19 'data lake and warehouse' combining comprehensive up-to-date clinical dataset, analytical capabilities and clinical experts evaluating clinical progression, prognosis, outcomes (**Ashworth, Douiri, Curcin**) (6 papers)
- Advising WHO and Japanese Government (**Shibuya**)
- Ireland Health Research COVID-19 funding Board (**Wolfe**)
- Tracking public attitudes, beliefs, and behaviour around vaccination (**Wolfe/Policy Institute/IPSOS-MORI** - King's Together funding).
- The **NHSE/I London Evaluation Cell** evaluating service innovations (e.g., remote/virtual service delivery) (**Sevdalis**).

1.3 Research Culture

1.3.1 Equality, Diversity and Inclusion (EDI)
UOA2 departments have strong EDI plans with engaged, proactive diversity committees and leads (Section 2) supported by Faculty-run initiatives, resulting in a truly inclusive culture with transparent processes for appointments, promotions, mentorship and PhD supervision. Public and patient involvement is central to this agenda, developing, conducting and communicating research locally in multi-ethnic south London and in diverse global research partnerships.

1.3.2 Open Research and Research Integrity
King's is a member of the UK Reproducibility Network. King's Libraries support Open Access including managing, curating, and disseminating publications and research data (**King's Open Research Group Initiative**). This includes support with data management plans and options for

storage, preservation, and dissemination of data. King's is a signatory to the San Francisco Declaration on Research Assessment. We are compliant with the Concordat on Open Research Data and the Concordat to Support Research Integrity at institution level. King's has introduced a formal, enhanced structure with FoLSM having appointed a Vice-Dean as Research Integrity (RI) Champion, and RI advisors in each of the Schools (**McKevitt, Gulliford**) providing support and advice on best practice and encouraging early reporting of research misconduct. The RI role is part of a wider leadership role within each School/Department, as Research and Impact Lead. Both the **NIHR Research Design Service (RDS)** London (hosted in SPHES), the School Research and Impact lead and UOA2 researchers act as reviewers of proposals before submission and as interviewers on 'mock' panels for early career research fellowship awards.

King's has joint NHS/King's Research and Development offices on each campus that provide advice on Health Research Authority applications, a monthly 'one stop shop' for researchers on infrastructures to support developing and executing their research as well as training on ethics and governance.

1.4 Progress against REF2014 strategy for research
UOA2 has built on the **REF2014** strategy of improving public and environmental health, and the organisation and delivery of health and social care, through translational research, harnessing the additional skills in global health, implementation science and policy since 2014.

1.4.1 Air Quality
King's Environmental Research Group (ERG) (**Kelly**) aims to understand the impact of atmospheric pollution on health and evaluate interventions. King's London Air Quality Network (LQAN) (2008-), is Europe's largest and most sophisticated regional monitoring network, that enables analysis of sources of atmospheric pollution and estimation of health implications of individual pollutants and investigation of impacts of air quality improvement policies such as the London Low Emission Zone (LEZ).

In 2018, NIHR funded the ERG to investigate the impact of London's Ultra-LEZ (ULEZ) on children's respiratory health (**Mudway**) and were successful with multi-university UKRI Strategic Priorities Funded programmes to enhance atmospheric measurement infrastructure (**Green**), policy modelling to include sensitive health groups (**Barratt**), and assessing toxicological impacts of air pollution on human development (**Mudway**). In 2009 the **Medical Research Council (MRC) Centre for Environment and Health** was formed with Imperial College London as the 'go to' Centre for research and policy on environment and health issues, as evidenced by the exceptional third renewal phase in 2019. King's successfully renewed the **Health Protection Research Unit (HPRU) in Environmental Exposures and Health (Kelly)** and co-leadership of the **HPRU in Chemical Radiation Threats and Hazards (Phillips).**

1.4.2 Stroke and Long-Term Conditions
The stroke programme (**McKevitt, Wolfe**) generated £6M research income since REF2014. King's has conducted epidemiological and health services research using the **South London Stroke Register** (**SLSR**), and the national stroke audit (**SSNAP**), with its embedded research programme, hosted at King's.

King's has uniquely estimated stroke risk trends over 20 years, outcomes up to 15 years after stroke and contributed to the **Global Burden of Disease estimates** using SLSR and SSNAP data. The **Burden of Stroke in Europe** report, in collaboration with the Stroke Alliance for Europe, identified inequalities in stroke risk and shortcomings in prevention and acute care, and highlighting the lack of longer-term care. King's has collaborated with UCL, evaluating large scale transformations of stroke care, demonstrating achievable, sustainable and cost-effective improvements in evidence-based care with improved outcomes in London and Manchester. SSNAP funded research demonstrated a complex relationship between admission times/days and access to evidence-based care not explained by lack of resource at night or weekends (Lancet, PLOS Medicine). Using SSNAP data with Health Foundation funding, we are deploying machine learning methods to refine quality improvement analytical methodologies in stroke care.

This research forms the basis of an Impact Case Study. **McKevitt** is the social science lead on Newcastle, Cambridge, Leeds and Nottingham NIHR programme grants, conducting nested qualitative evaluations in post-stroke care.

UOA2 stroke rehabilitation research provides expertise in evaluation of fidelity, efficacy, and effectiveness of rehabilitation interventions (e.g., vulnerable groups post stroke; severe stroke; visual problems; residential care and upper limb movement limitation). An NIHR Global Health Research Group has been funded to estimate stroke risk and develop a care pathway for improving care quality after stroke in Sierra Leone (**Sackley**). Funded work in other long-term conditions includes: Parkinson's disease; fractured neck of femur (**Sheehan, Sackley**); rheumatoid arthritis and peripheral arterial disease (**Bearne**).

White has addressed service delivery and appropriate prescribing for **chronic obstructive pulmonary disease** (**COPD**) and has international and national collaborative projects on C-reactive protein point of care test in COPD. Health economic research has informed guidance for cardio-thoracic, respiratory and oncology societies to recommend talc pleurodesis for patients with mesothelioma following a trial that showed no worse survival, fewer complications and a shorter hospital stay (**Fox-Rushby**).

UOA2 research (**Gulliford**) identified the effectiveness of implementing antenatal and newborn screening for sickle cell disease and led the implementation of the national NHS screening programme in the UK and internationally (Impact Case Study).

1.4.3 Statistics, Digital Infrastructure and Electronic Health Records Research (EHR)
The **Medical Statistics Group** undertakes research in outcomes modelling, trial designs, precision medicine, meta-analysis, and clinical decision support. The group contributed to over 107 trials (Phase 1-3) (3 New England Journal of Medicine) with research grant income of £2.4M to UOA2 (£100M to partners) from MRC, Wellcome, NIHR and industry (14 studies). They have led on the design and analyses of 58 phase 1 and 2 trials (dose escalation and first in human) and biomarkers (e.g., liver failure prognostic models) (**Ayis, Douiri, Reid, Wang, Bunce, Peacock**). Of note are the impactful analyses of peanut allergy trials, the results of which have transformed management (**Lack** (**UOA1**), **Ayis, Peacock**).

Health informatics research has developed Learning Health System solutions for linking and analysing large datasets from EHRs and developing their application to trials. Areas of focus include EHR-driven trials, phenomics, machine learning based decision support systems, research reproducibility and using social media data as a digital signal. **Curcin** leads the KCL Trial and Phenomics themes of the **NIHR/MRC Health Data Research (HDR) UK** network London and directs the **Centre for Doctoral Training in Data-Driven Health**.

EHR Research (**Gulliford**) has shown obesity is a key driver of multiple long-term conditions and provided new evidence on trends in children's obesity; estimates of the low probability of an obese person transitioning to normal weight; evidence for the impact of widespread antidepressant utilisation on obesity and new evidence that bariatric surgery is associated with reduced incidence of new-onset diabetes. CPRD data has been used for health economic modelling with novel results for costs and outcomes of increasing access to bariatric surgery and costs of health care utilisation in older adults (**Gulliford**). **Fox-Rushby** has developed a new economic model showing brief interventions in primary care are a cost-effective way of increasing physical activity that was used to support the National Institute for Health and Care Excellence (NICE) public health guidance.

Gulliford developed the use of CPRD EHRs to conduct randomised cluster trials, with >600,000 participants randomised, and implemented individually randomised pragmatic trials of enhanced invitation methods for the NHS Health Check Programme and antimicrobial stewardship interventions that identified bacterial infections as safety outcomes of reduced antibiotic prescribing. With Cardiff and Oxford, **White** has developed low-cost antimicrobial stewardship interventions deliverable into GPs EHRs.

1.4.4 Implementation Sciences

UOA2 has played a key part in **the South London Collaboration for Leadership in Applied Health Research and Care (CLAHRC)** (2014-19), and **Applied Research Collaboration (ARC)** (2019-). **Sevdalis** has developed the Centre for Implementation Science, hosting over 40 scientists and staff, integral to themes in the ARC. The Centre also focuses on global health research, implementation methods and measures development, and improvement science applications to advance and evaluate innovative service improvement across South London. Evaluations include smartphone use by surgical patients, impact of a UK-wide improvement skills training programme for urology trainees, and safety incidents in primary care and community-based mental health services.

1.4.5 Policy Institute

The Policy Institute works to combine the rigour of academia with the agility of a consultancy and connectedness of a think tank. The Institute ran a responsive research facility for the Chief Medical Officer, Dame Sally Davies, addressing crosscutting public health and social policy topics including anti-microbial resistance, obesity, pollution and genomics (**Grant**). Policy Labs, pioneered by King's (**Pollitt, Grant**) bring stakeholders together to address how research findings can be put into policy and practice and these have addressed reducing costs associated with rising levels of Type 2 diabetes, developing interventions to tackle long-term mental health outcomes of bullying and outlining ways to progress key areas of the Mental Health Act.

Since 2014 King's has provided evidence to understand and assess the impact of research, that played a key role in UK research policy and helped the UK government uphold its 2.4% R&D target. It influenced the effectiveness and efficiency of biomedical and health science policy in Scotland and informed REF2021 guidance and contributed to an improved understanding of research processes nationally and internationally (**Grant**).

1.4.6 Global Health

UOA2 works through **King's Global Health Partnerships** (**KGHP**) to strengthen health systems and improve care quality in LMICs: Democratic Republic of Congo; Sierra Leone; Somaliland, and Zambia. Research is focussed in 3 areas: NIHR Stroke in Sierra Leone (1.5.2); **NIHR ASSET Centre** - Health systems strengthening in Sub-Saharan Africa, and 'ASPIRES' - optimising antibiotic use along surgical pathways (**Leather**, **Sevdalis**). Global surgery research has demonstrated improved surgical safety with checklists, the assessment of trauma systems, interventions to improve neonatal surgical outcomes, global surgical metrics and national surgical policy (**Leather**). **Leather** co-chaired the Lancet Commission on Global Surgery reporting on surgery in LMICs and plans to strengthen surgical and anaesthesia provision to 2030. Both implementation sciences and KGHP benefit from being integral to **King's Global Health Institute (KGHI)**, a cross-university interdisciplinary centre for research education and training.

1.4.7 Toxicology and Forensic Sciences

Toxicology and forensic sciences undertake research relevant to public health, particularly in its biomarkers of drink- and drug-drivers programme (**Wolff**). Rising road-traffic collisions attributed to driving under the influence of drugs led to a new liability offence introduced into legislation in 2015, underpinned by the research. In the first 316 days an estimated total of 8,599 convictions took place removing dangerous drivers from roads. Data from 40 police forces showed 8,336 drivers tested positive for cannabis and 3,064 for cocaine between March 2015 and January 2018 (Impact Case Study). **Syndercombe-Court** leads the London branch of the **Metagenomics and Metadesign** projects sampling the Subways (London Underground) and Urban Biomes (MetaSUB). The group identified the DNA profiles of the residents of Grenfell Tower and work from within our accredited laboratories has contributed to another REF2021 case Impact Case Study, Anti-Doping (Sochi Anti-Doping corruption investigation) (**UOA24**).

Genetic & Environmental Toxicology explores the impact of exposure to chemicals on humans and wider environment. Toxicogenomics (**Sturzenbaum**) utilizes macro-invertebrate models to study the impact of exposure to xenobiotics encompassing the elucidation and characterization of response cascades, from molecular genetic to life cycle end-points. Environmental

Carcinogenesis (**Phillips**) use 3D organoid tissue cultures to investigate what carcinogens do to cells and what cells do to carcinogens. The investigation of mutational signatures of environmental carcinogens and chemotherapeutic agents revealed patterns of mutations characteristic of both endogenous cellular processes and exogenous factors such as environmental carcinogens (e.g., tobacco smoke).

1.5 Impact

The impact of King's research is a core value of UOA2, and the concepts of impact have been pioneered by the Policy Institute's (**Grant**) research on **REF2014 impact** and the development of Policy labs as well as influencing the NIHR's values framework and Impact strategy (**Wolfe**, Chair NIHR Impact Board). The Policy Institute has developed training on research impact and policy communications for King's students and staff, and external bodies e.g., the Royal Society. This draws on policy research and analysis of the REF2014 case studies which contributed to the design of REF2021 (**Grant, Pollitt**).

UOA2 researchers are active in promoting the implementation of research leading to patient and population benefits and impact is now built into our staff development and promotion process. We support and encourage researchers to develop impact by conducting needs-led research, involving stakeholders in the design and conduct of relevant research, as well as promoting the dissemination and implementation of high-quality research through engagement in health policy, quality improvement and service innovation. We encourage staff to build relationships across sectors to accelerate impact opportunities, and to take up roles outside the university including secondments to stakeholder groups (Section 4).

The exemplars of our impact are illustrated in our Impact Case Studies in Air Quality, Stroke, Sickle Cell Screening, and Drug Driving.

1.5.1 Public and Patient Involvement (PPI) and Community Engagement: PPI is central to the research in UOA2 for influencing policy, service delivery and developing pathways to impact. In addition to facilitating the practice of PPI within King's and UOA2 research, we also research PPI approaches, thinking critically about how best to engage diverse publics and incorporate these individuals in the design, delivery and dissemination of research (**McKevitt**), what counts as meaningful PPI, and contributing to the research underpinning NIHR INVOLVE's adoption of co-production. The **NIHR Biomedical Research Centre (BRC)**, with UOA2 researchers' support, facilitates the involvement of patients and carers in research at GSTT NHS Foundation Trust, supporting multiple condition-specific PPI groups (e.g., stroke, COPD, cardiovascular) with a Research Advisory Group for oversight. The Centre for Implementation Science works closely with BAME communities and service user groups and engages NHS Trusts and the Health Innovation Network to promote scalable innovative services across South London. The **NIHR RDS** has developed through UOA2 researchers innovative PPI engagement, guidance, and advice.

1.6 Future Research Strategy

The future of UOA2 research programmes is rooted in **King's 'Vision 2029'** and we envisage an open, engaging and dynamic environment with an ambition to substantially increase academic capacity, focus on strengths and building upon our collaborations across King's, nationally and globally.

1.6.1 Recruitment and Leadership

The departure of the Air Quality group to Imperial College to form a university MRC centre, and recruitment to other vacant posts, provides us with opportunity to re-focus. **King's has Population Health as a priority,** and we are working with the Senior Management Team to shape a strategy that underpins our research ambitions. We will recruit future **leaders in public health, data science, health informatics, social sciences and primary care** and develop junior Faculty and early career researchers (ECRs) into senior roles. Within these domains we will focus on posts addressing urban population health inequalities, multiple long term conditions, facilitating experimental medicine through links with the **NIHR BRC** and implementation and impact through the **NIHR ARC** and the **Policy Institute,** and research programme stakeholder engagement. We

will **support our rising research stars** and extend our UKRI Future Leaders and nationally competitive postdoctoral awards through our new programmes and infrastructures.

1.6.2 Infrastructures
In 2019 King's invested in a cross-university **Institute of Population Health** (**IPH**) (**Shibuya**) that we will draw on in the next period as it develops. IPH aims to complement the work of SPHES by establishing and promoting a cross-disciplinary, data-driven platform for population health research that aligns with our research (see 1.4.3). An exciting collaboration with the **Artificial Intelligence Centre for Value Based Healthcare** (**DHSC funded £16M**) will strengthen our work in the NIHR BRC and address questions in large NHS data sets with linked research data (e.g., Omics), harnessing university high performance computing and NHS procurement of a £2BN EHR system locally.

We will integrate further with **King's Global Health Institute (KGHI)** to strengthen our expanding research programme and partnership working in LMICs as well as linking the IPH and KGHI to strengthen population, systems and patient focussed research. We will collaborate with an IOPPN initiative with PLUS Alliance (Arizona State University and UNSW Sydney) to establish a **Centre for Public Mental Health** that has synergies with our research programmes.

We propose integrating our research and education programmes with the FoLSM **School of Life Course Sciences** (women and children's health, nutritional sciences, diabetes, twins and genetic epidemiology), establishing a critical mass of researchers dedicated to research across populations and the life course.

1.6.3 Research Programmes
Stroke and other long-term conditions: We will advance the development of stroke services in Sierra Leone and the SLSR programme will broaden to include the new ICD-11 classification of stroke, inclusion of vascular morbidities and patient portals. SSNAP data will be used to analyse the ongoing effects of COVID-19 on care and outcomes and estimate trends in the quality of care and identifying inequalities. We will undertake further trials in falls, joint diseases, peripheral arterial diseases and a national trial of pulmonary rehabilitation with lay health workers.

Statistics, Digital Infrastructure and EHR: The **statistics** group will: focus on developing methods for experimental medicine trials with the BRC, increasing the portfolio; develop prediction modelling using AI and advanced statistical methods (long term conditions and polygenic risk scores); collaborating with national Quality Improvement programmes (e.g., stroke, falls) to refine estimates of outcome using AI/statistical approaches. **Health informatics** will lead on developing a Trusted Research Environment (TRE) with an underpinning programme in provenance, phenomics, electronic trials and decision support. We will expand our primary care EHR infrastructure to 2 Boroughs with linkage to the TRE and expand our **EHR trials** programme in COPD, stroke and antimicrobial stewardship.

Implementation Sciences and Impact: Developing the implementation methodologies through the NIHR ARC themes and global partnerships, along with integration with other UOA2 programmes, will strengthen all research and enable impact to be developed with Policy Institute engagement and use of policy labs and their extensive range of stakeholders.

1.6.4 Postgraduate Research
We will secure **EPSRC** funding for the Centre for Doctoral Training in Data-Driven Health, continue the London Interdisciplinary Social Sciences Doctoral Training Partnership (**ESRC**) and increase the number of externally funded PhD and postdoctoral fellowships enabled by our increased Faculty capacity and refreshed research focus.
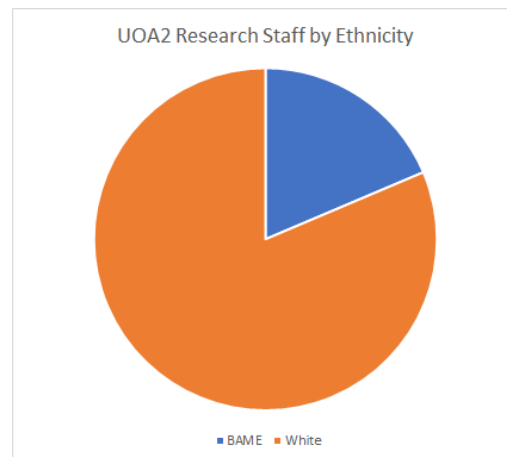
2. People

UOA2 comprises 43 (38.85 FTE) academic staff returned to REF2021, and approximately 200 other research, scientific and administrative staff. King's promotes the Principles of the Concordat to Support the Career Development of Researchers and the European Commission's HR Excellence in Research Award which King's has held since 2012, recently renewing it for 2020-22 with the Centre for Research Staff Development (CfRD) overseeing the work.
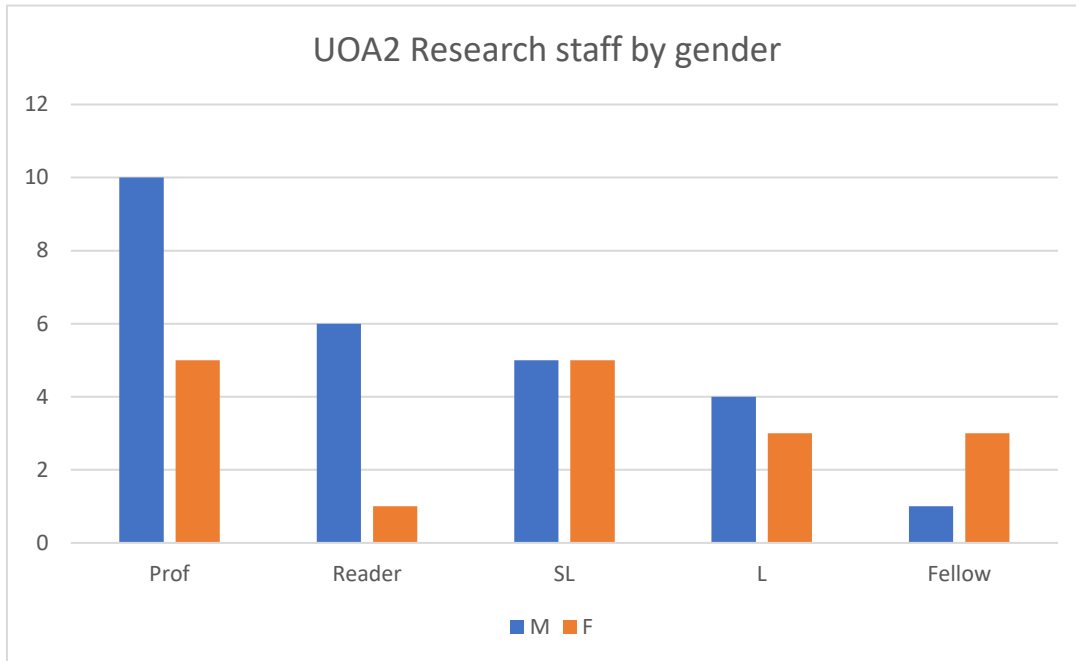
Figure 3: UOA2 staff submitted to REF2021
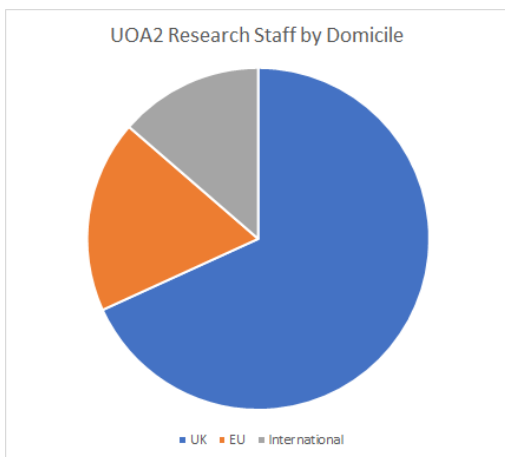
**Figure 4: UOA2 staff by domicile**   **Figure 5: UOA2 staff by ethnicity**

2.1 Staffing Strategy and Staff Development

UOA2's staffing strategy is based on developing an interdisciplinary, diverse and collaborative team who focus on delivering UOA2's current and emerging research priorities. Staff operate within a high-performance culture built on supporting success within King's ambition. An **Academic Performance Framework** (APF) supports staff by articulating levels of attainment at each academic grade within research, education, academic citizenship, and knowledge dissemination and impact. The APF informs and is central to recruitment, probation, promotion and appraisal.

2.1.1 Academic Recruitment, Probation and Promotion

Recruitment: We ensure recruitment is fair, under-represented groups are encouraged to apply, and appointment panels are diverse. We aim to recruit and retain "rising stars" rather than senior figures. **Since REF2014 29 new members of academic staff have been recruited** in UOA2. A significant proportion (45%) have been at Lecturer level to drive our talent pipeline.
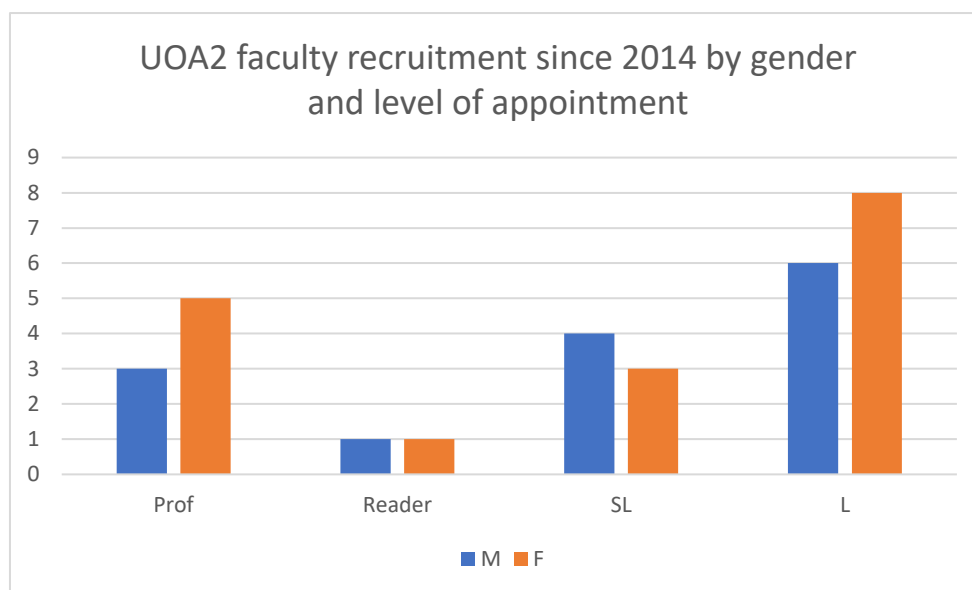
Figure 6: UOA2 recruitment since 2014

Probation: New academics complete a three-year probation. During 2020, FoLSM undertook a review of academic probation to ensure the best possible support for probationers and to secure diversity throughout the process. In UOA2 we provide support with assistance in writing probation reports and conducting mock interviews.

Mentoring: Academic staff are provided with a mentor on appointment. King's has developed programmes available to staff, including ones dedicated to staff with protected characteristics "More than Mentoring" (prioritises women), BAME, LGBTQ+ and those with disabilities. A mentoring platform for ECR staff is provided by the CfRD and provides career progression support, and help in establishing independence, gaining confidence, developing skills, and enhancing networks. CfRD has an online mentoring platform to help researchers identify the right mentor, from within King's or beyond academia. UOA2 researchers are also involved in national schemes e.g., Academy of Medical Sciences.

Performance Review: Academic and research staff complete an annual appraisal, that affords an opportunity to celebrate success and agree objectives for the coming year and what needs to be in place for success. Personal circumstances which might impact performance are considered. For clinical academics, a dual appraisal process with NHS and university assessors, operates.

Promotion: King's recognises colleagues who have demonstrated the highest quality research, innovation and where appropriate clinical excellence and eminence against transparent criteria. UOA2 has been very successful in supporting academic promotions since 2014 (Figure 7). UOA2 works closely with staff on developing applications and provides peer review and workshops on writing successful applications.

Succession planning: Academic leadership roles within Schools/Departments last 3 years, renewable for a further term. Each of these roles is advertised, with shortlisting and interview, providing people with leadership opportunities. Succession planning for individual academic appointees is discussed at performance review and through discussions with the Faculty Executive, all Schools having input to the decision making.
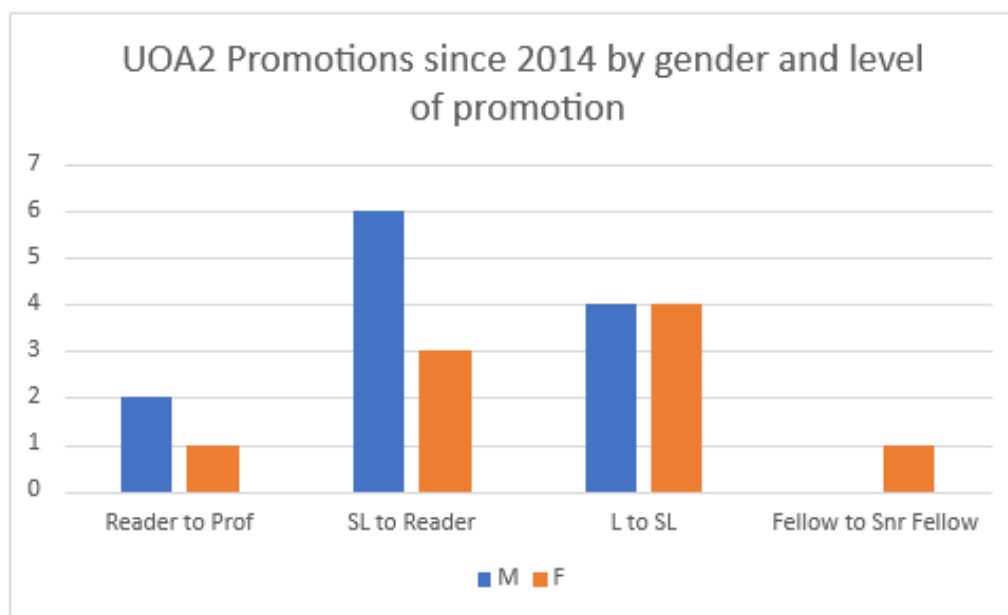
Figure 7: UOA2 promotions since 2014

2.1.2 Staff Development and Research Culture
Support for academic and research staff: All grant submissions are constructively peer-reviewed (Section 1.3.2). We encourage staff at all career stages, to develop their knowledge and skills, and gain breadth and depth of experience. In addition, the **King's Research & Strategy Development Team** provide researchers with access to a Research Development Manager who provides advice and support throughout a grant application – from identifying opportunities through to facilitating internal peer review. The Team provide dedicated support to large funding bids and programme grants, seek opportunities to strengthen relationships with funding bodies and facilitate collaboration across King's. Support has helped secure our NIHR Global Health Centre and groups, Centre for Doctoral Training and UKRI/MRC career development and infrastructure bids (Air Quality).

UOA2 collaborates with the London Deanery and Health Education England to deliver postgraduate medical training and currently hosts **NIHR Academic Clinical Lecturers** in primary care (3) and public health (1), with support from the NIHR Integrated Academic Training (IAT) programme and King's Education Academy. We also host **NIHR In-practice Fellows** (6 since 2014) in primary care. We currently host 2 **MRC Postdoctoral Fellowships** (**Marshall, Schofield**).

UOA2 has researched the expanding UK clinical research delivery workforce through formalisation of the role of Clinical Research Practitioner, showing these individuals support research delivery, addressing recruitment gaps caused by the shortage of research nurses, and identifying the need for further training, oversight, and career development (**McKevitt**).

Leadership and management development: The Organisation Development Team has developed leadership programmes to develop a community of leaders to lead teams effectively and deliver King's Vision 2029. The programmes build leadership capacity, increase networking opportunities and develop a coaching culture. The **Leading Researchers Programme** (LRP), aimed at Readers and Professors, supports skills such as generating and developing big ideas; taking risks and cross-disciplinary collaboration; and gaining insights into funder requirements. **Emerging Leaders Programme** (ELP) is aimed at mid-level staff developing their leadership. UOA2 has seen colleagues progress through the LRP (**Curcin, Douiri, Fox-Rushby, Redmond**) and ELP (**White, Pollitt**). **Curcin** has subsequently taken on leadership roles in HDRUK, Centre for Doctoral Training, and NIHR BRC Data analytics cluster. **Douiri** now heads the statistics group and **Fox-Rushby** collaborated on NIHR Global Health bids and leads the UOA2 ECR initiatives.

King's support women leaders utilising national programmes, Aurora – Developing women leaders in higher education (**Ayis**) and as Role Model (**Ayis**) and BAME colleagues through the StellarHE development programme (**Sorinola**). As well as development schemes open to research staff e.g., Faculty Research Conference Fund and the NIHR BRC, UOA2 has a Fund open to all staff and students, since 2014 >£70K has been utilised.

2.1.3 Support for early career researchers
The CfRD and Centre for Doctoral Studies (CDS) provide training and development for post-doctoral research staff, postgraduate research students and supervisors. Through the NIHR RDS and the NIHR BRC UOA2 provide additional training for academics and researchers.

A UOA2 **Early Career Researchers and Teachers Network (ECRTN)** was established in 2018 with senior input (**Curcin, Fox-Rushby, Peacock**) to support ECRs from pre-PhD to Lecturer in developing careers, research programmes and social opportunities as well as representing ECRTs through School, Faculty and College governance. There is now an active committee of 18 running the network of over 125. Events held include: improving your career prospects online; CV Clinic/Writing Tips; Research Fellowship Forum; Tips for Preparing Fellowship Applications; Enhancing prospects of success in academia; and Integrating Teaching Opportunities with Research. A 2019 proposal writing workshop provided an overview of successful grant writing techniques from UOA2 grant holders with NIHR CRN and RDS.

UOA2 has an active weekly seminar programme led by ECRs, drawing upon expertise from within UOA2 and beyond to share research. Throughout COVID-19 these seminars continued virtually and are well attended.

UKRI Future Leaders: UOA2 has been successful two years running. A programme of research has been established, exploring experiences of homelessness, linked to welfare reform, legal support services, efficacy of peer support interventions (**Guise, Social Science**). **Sheehan (Health Services Research, Rehabilitation)** is analysing national fragility fracture audit data linked to EHRs to inform quality improvement initiatives after hip fracture.

2.2 Research students
2.2.1 Funding: Research students are funded from Research Council awards (MRC, BBSRC, EPSRC, ESRC, NERC); UK charities (Wellcome Trust, Dunhill Medical Trust, The Healthcare Improvement Studies Institute etc); European Union; NIHR Fellowships, grants and BRC; overseas funding agencies (Governments of Saudi Arabia, Indonesia; the Crown Prince International Scholarship Programme of Bahrain; Chinese Scholarship Council); industry (Glaxo Smith Kline); the ESRC London Interdisciplinary Social Science Doctoral Training Programme's (DTP), including CASE awards with local partners (Transport for London, London Ambulance Service); the London NERC DTP, including CASE awards with industry (Bosch, Dyson, and Emissions Analytics); and joint awards with other Faculties further fostering interdisciplinary collaboration.

2.2.2 Selection: Potential candidates either select projects submitted by academics to diverse training schemes or our associated Doctoral Training Centres (DTCs); direct approach, or open advertisement of potential areas of interest. Applicants are subsequently selected through interview by a minimum of two independent academics, on the basis of their academic potential.

2.2.3 PhD Infrastructures: UOA2 provides leadership (**Schofield**) for the Health Practices, Innovation & Implementation theme of **London Interdisciplinary Social Sciences Doctoral Training Partnership** (ESRC), that provides studentships, training, and support for doctoral research around 13 cross-cutting pathways in domains of health, regulation and public services, social change, and security.

Curcin leads **DRIVE-Health,** a new (2020-) pilot CDT funded by King's (£1.3M) to leverage industrial funding for health data science PhD research. The centre will recruit 10-12 students annually for three years. DRIVE-Health will equip students with skills to develop and deliver new

models of data-driven healthcare and biomedical research with real world impact. The CDT is supported by an international network of partners across industry, government and the public and third sectors, including the NHS, digital health innovators and SMEs providing studentships and hosting students.

2.2.4 Personal, Professional and Career Development
Students have access to the CDS's innovative resources including face-to-face workshops, online courses, and seminars, including communication & impact, IT essentials, data management, and writing and publishing. Students meet with careers consultants and/or Royal Literary Fund writing fellows. Specialised training is offered via DTCs and DTPs. Students within UOA2 also access opportunities from the Heath Sciences DTCs (2014-) to enhance research, professional and personal development skills. Research students' progress and well-being is overseen by a School Postgraduate Research Lead (**Curcin**) and Department PGR Coordinators (**Ballard** and **O'Connell**).

In 2017 the CDS funded a UOA2 PhD student to investigate the PhD supervisory experience within UOA2. For supervisors, findings highlighted: managing student expectations; access to useful information about university processes; and access to appropriate continuing professional development for supervisors. For students, findings included: improving the usefulness of Thesis Progression Committees (TPC) for students; avenues for pastoral support and communication with supervisors. Postgraduate Research Experience Survey scores indicated 86% satisfaction overall in 2019 (identical to 2017).

Supervision: Each student is assigned two supervisors one of whom has previously supervised a student to completion. Joint supervision involving staff with different disciplinary bases is promoted. UOA2 has supported ECRs by creating third supervisor role to provide the necessary experience to act as future first supervisors. A TPC chaired by an independent academic and populated with project experts is responsible for monitoring progress, organising MPhil/PhD upgrade transfers and providing independent advice and pastoral support. This level of monitoring and support underpins our high completion rate.

PhD supervisors are required to undertake supervisor training through the CDS to ensure high-quality supervision. There is a Supervisory Excellence Award for each Faculty and an overall winner for the university. In 2019, **Sturzenbaum** was the overall winner in FoLSM and winning the university award.

Submission and completion data for PGR students: For full-time students UOA2's overall submission rate is 97.8% (94.4% within 4 years) with a completion rate of 96.4% (95.2% completion within 5.5 years). Submission rates for part-time students are overall 92% (88% within 7 active years) and completion of 92% (84% completion within 8.5 years).

PhD student's integration into the wider research environment: Students within UOA2 participate in journal clubs, a PhD & Pizza Seminar series and an annual symposium organised by the ECRTN. The Annual Symposium is a vibrant programme where all students present a poster or an oral presentation. These events have continued virtually throughout the COVID-19 period. PhD students also present their work regularly at Departmental seminars. Students are encouraged to submit abstracts to conferences for which financial support is provided both at Faculty, School/Department and CDS level.

Several students actively engage in **public engagement and outreach** activities providing opportunities for professional development, e.g., public speaking. Our research students have been recognised for their efforts e.g., presented research to HRH Princess Anne on behalf of the Royal Commission, following a presentation at the Royal Commission for the Exhibition of 1851 Alumni event; and another student won the 2019 UK Big Data Zone for "I'm a Scientist, Get me out of here!".

2.3 Equality, Diversity and Inclusivity (EDI)

We are passionate about the role and importance of leadership in visibly championing our commitment to EDI principles and ensuring they feed into all decision-making and operations, including the development of the UOA2 return; developing the diversity of skills and talent within our community; ensuring all present and prospective members of staff and students are treated solely on the basis of merit, ability and potential without any discrimination; providing and promoting a positive working, learning, and social environment free from prejudice, discrimination, harassment, bullying or victimisation.

These principles are followed from recruitment to appointment to positions of responsibility. Recruitment and other panels are chosen to reflect diversity in experience. Diversity Matters and unconscious bias training is provided for all line managers. King's is a member of the **Stonewall Diversity Champion Scheme** (2015-) and participates in the annual Workplace Equality Index exercise. The university holds a **Bronze Race Equality Charter Mark** (re-awarded 2020) and made a Silver Athena SWAN institutional submission (2020). FoLSM and IOPPN hold **Athena SWAN Silver awards.**

In FoLSM a Vice-Dean for Development, Diversity & Inclusion was created in 2018 and sits on the Faculty Executive Board and ensures that EDI principles and priorities inform strategic planning and outcomes through the framework of the Faculty Executive Board EDI Pledge. Across UOA2 there are networks for discussion and improvement of EDI. UOA2 constituent units have an **academic lead for EDI** to champion and coordinate efforts. EDI Core Team members sit on FoLSM and IOPPN committees, the UOA2 REF Working Group, King's Equality and Diversity Advisory Panel, promotion and senior interview panels, and pay recognition panels. EDI is a standing item at all meetings.

The 2017 King's Staff Survey showed 96% of FoLSM staff were **aware of our commitment to EDI**; 91% agreed we were **committed to an inclusive environment**; and 92% agreed we **acted fairly, regardless of protected characteristics**. A Faculty Staff survey (2018) showed 95% of staff are aware of Athena SWAN. Staff surveys show an increased proportion of staff taking up informal **flexible working** (73%); 83% of new starters agreed their induction was welcoming; and 77% agreed that development was discussed effectively in appraisals. UOA2 is now actively considering the post-COVID ways of working to ensure that new approaches to working flexibly are embraced and staff are supported, including with the resources, to thrive in an agile environment.

2.3.1 Training: EDI training is key to our approach for an inclusive environment, including mandatory training for leaders and recruiters. Training includes implicit and unconscious bias, imposter syndrome and **Diversity Matters and cultural competency** - sessions centred around King's EDI strategies. Since 2014 the proportion of staff who are aware and attend EDI training has increased annually; by 2018 86% of staff were aware of our Diversity Matters training. Advancing Race Equality is a key goal, in 2020 regular sessions have been developed and delivered through Faculties focused on race equality terminology, microaggressions, white privilege and inclusive language. Bespoke **race equality training** was delivered to the Faculty Executive Boards. The Race Equality Network organises events including Black History Month. UOA2 hosted a seminar titled "Research into the black and minority ethnic groups (BAME): helpful, harmful or habitual?" to engage our researchers actively in addressing these challenges.

We also offer mentoring and peer support through the Research Staff Online Mentoring Platform and **reverse mentoring for BAME staff**. The career progression and retention of female scientists and researchers and the adoption of Athena SWAN principles from the point of recruitment, ensuring interview panels have appropriate gender diversity. There is a significant emphasis on a family-friendly work environment. **Visible female role models** are important in inspiring and guiding early career female researchers. UOA2 undertook research on gender equity programmes within medicine, finding the Athena SWAN Charter often unintentionally reproduces and reinforces gender inequity in its implementation (**McKevitt**). In 2020 work to support our approach to race equality began with our social science researchers working with the African-

Caribbean Medical Students Society looking at decolonisation within the curriculum and ensuring diversity within medical teaching e.g., dermatology (**Guise, Wyatt**).

2.3.2 Culture and Bullying: Our researchers follow guidance set out in King's code of practice and are pro-active in recognising and reacting to workplace intimidation. As part of the PhD review process, the TPC explores the student-supervisor relationship in the absence of the supervisor to ensure vigilance against potential bullying and harassment. UOA2 students receive a handbook explaining the level of commitment a student can reasonably expect from supervisors. As part of our zero tolerance towards bullying and harassment, a **Confidential Advisors Service** in FoLSM is open to any member of staff experiencing bullying and harassment (**Schofield** represents UOA2 as an advisor). Additionally, FoLSM are in process of implementing a Cultural Change Initiative, which has used qualitative evidence collected from across FoLSM to inform a coaching and training programme for Leadership, to improve their confidence and capability in role modelling best practice and inclusion.

2.3.3 Support for parents and carers: We have identified barriers to uptake of paternity and shared parental leave and improved access to information. During parental leave, staff may avail of 10 'Keeping in Touch' Days for work-related activities without impacting pay. Staff can apply for £10,000 from the **King's Parent and Carers Fund**, to attend career-development events outside working hours.

3. Income, infrastructure and facilities

King's has access to an impressive breadth of local, regional and national high-quality research infrastructures essential to ensuring our research remains at the cutting edge and is rapidly and effectively translated into impact for society. UOA2 plays a significant role contributing to collaborative research with underpinning public health, primary care and health services research infrastructures within the university, and across London, to build capacity, leverage new funding and enhance collaboration.

3.1 Research Income

UOA2 attracted more than £54M in research income during the assessment period. The average annual research income of **UOA2 increased from £6.24M in 2013/14 to £9.28M in 2019/20.** NIHR funding significantly strengthened the methodological basis for applied research within King's, across King's Health Partners (GSTT NIHR BRC (£77.5M since 2014, £7.5M to UOA2 which has leveraged £352M of research income since 2014), and the NIHR HPRU and MRC Centre for Environment and Health (£4.9M to UOA2 2014-2020). This enabled us to increase methodological support for translational and applied research at King's and the wider research community.
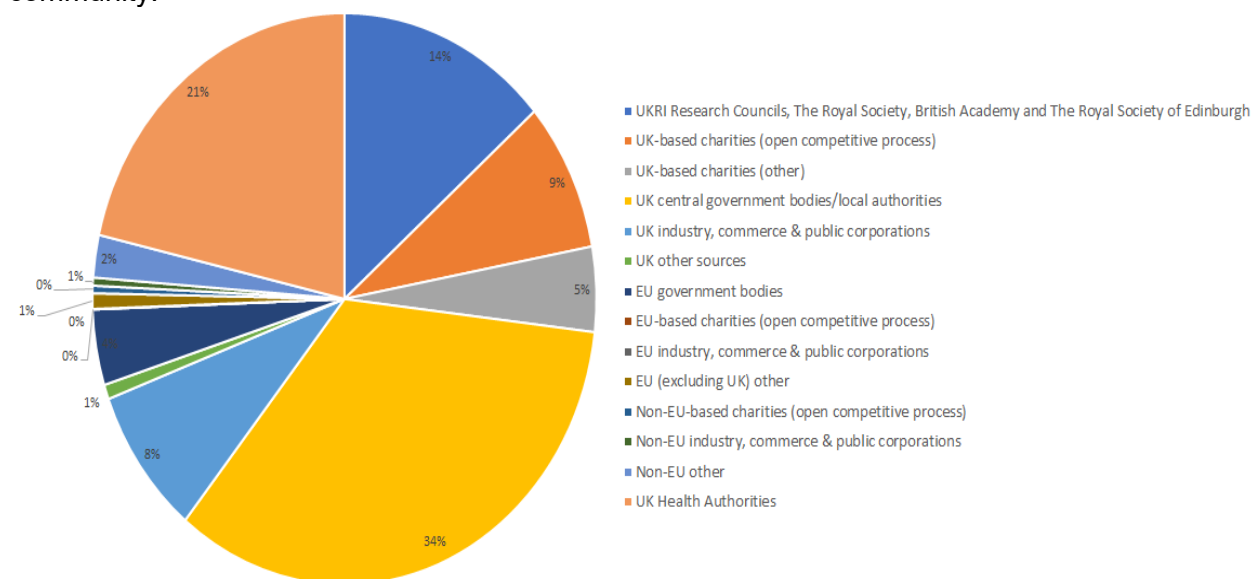
Figure 8: UOA2 research funding sources since 2014

3.2 Major infrastructures
The major collaborative infrastructure research awards for the period include:
- NIHR HPRU in Air Quality (£4.4M 2014-2020)
- MRC Centre for Environment and Health (£5.9M 2014-2019)
- NIHR BRC Data analytics cluster (£7.5M)
- NIHR ARC Public Health and Implementation Science themes (£4.9M 2019-2024); and its predecessor NIHR CLAHRC South London (£4M 2014-2020)
- NIHR RDS London (£11.9M, 2013-2023)
- NIHR CRNCC Speciality Hub (£3.4M, 2015-2022).

3.2.1 Providing the highest quality infrastructure and facilities to support research: The Department of Population Health Sciences has been relocated to a bespoke refurbished building since REF2014 at a cost of £3.6M that provides open-plan and agile working space enhancing cross-disciplinary collaborations and includes seminar and event spaces and a floor of conference/meeting rooms with video-conferencing capabilities.

3.2.2 Academic Health Sciences Centres (AHSC) accredited: King's is the academic partner in **KHP**, with local NHS Trusts, one of eight by the Department of Health and Social Care (DHSC) in England aiming to facilitate rapid transfer of new knowledge towards clinical practice, service delivery and health policy. King's UOA2 has made a defining contribution in developing the KHP **Urban Population Health** pillar within the AHSC strategy and is the academic lead for the **Medicine and Integrated Care Clinical Academic Group**, provides Implementation Science support to partner Trusts through **King's Implementation Science** initiatives and delivers seminars and lectures to King's FY1/2 and Integrated Academic Trainees. Our pan AHSC functions strengthens clinical, service and local stakeholder (Integrated Care system including Boroughs and Clinical Commissioning Groups) engagement in our research.

3.2.3 The NIHR Clinical Research Network Co-ordinating Centre Specialty Hub (CRNCC): supports patients, the public and health and care organisations across England to participate in funded research. King's is an **'Alliance' member** of five universities supporting the CRNCC (2015-2023). **Wolfe** chairs the Alliance group and is on the national CRNCC Board. There are two Cluster Leads with visiting professorial appointments (**Evans, Smye**). The King's Hub provides clinical leadership for eight Specialties including Health Services and Delivery Research; Mental Health; Primary Care; and Public Health. More recently the CRNCC has harnessed and exploited areas of emerging technology and innovation in areas of Genomics, Imaging and Translational Medicine enriched by current KCL infrastructure and partnerships (NIHR BRCs, King's Genomic Centre, CLAHRC/ARC), developing horizon scanning reports for NIHR and UKRI to allow specialties to adopt emerging methods and topics into the network's portfolio of research.

3.2.4 NIHR RDS London: UOA2 hosts NIHR RDS London (**Director, Wolfe**) (2008-2023), a successful partnership between King's, Imperial, University College and Queen Mary's performing a unique role at the interface between research commissioners and researchers across London. Our advisers work iteratively with research teams to develop proposals addressing complex health and social care challenges. From 2014-19, RDS London supported 2,772 teams, 55% submitted an outline/full application with 876 full submissions and a 48% success rate (£127M). **Lovell** (Co-Director) made significant contributions to national strategy and activity through leadership of the national RDS Strategy Group (2017-18) and membership of the NIHR Strategy Board (2017-18), synergising our support with other RDSs and NIHR infrastructures.

3.2.5 NIHR accredited Clinical Trials Unit (CTU): King's hosts the CTU at the **IOPPN** and statisticians in UOA2 form a hub for early phase trials within the NIHR BRC and later phase trials across KHP Trusts and others nationally. **King's Statistics Group** lead on consultancy and training within the BRC (over 200 sessions to 2000 participants since 2014).

3.2.6 South London ARC: UOA2 are partners in leading themes in public health (**Littlejohns**), stroke and multimorbidity (**Wolfe**), implementation science (**Sevdalis**), multiple morbidity (**Ashworth**), as well as providing leadership through Deputy Directorships (**Littlejohns,**

Sevdalis). The work of the ARC is underpinned by applied informatics using technology and big data systems to analyse population health, health economics and statistics (**Curcin, Carter, Douiri, Fox-Rushby, Pennington**). The implementation science masterclass (**Sevdalis**) for health and care professionals and applied scientists is in its sixth year, followed by the launch of the UK Implementation Science Research Conference, in its third year (2020). In 2018, improvement science specialists with NHS staff and service user groups developed a suite of open-access resources to support service improvement, patient engagement and evidenced intervention implementation, downloaded more than 8,500 in 2019. The Implementation Science Centre capacity development programme resulted in over 15 Improvement Science and NIHR Knowledge Mobilisation Fellows being hosted since REF2014, the majority of whom are now in Faculty roles within UK academia.

3.2.7 NIHR Biomedical Research Centre (GSTT and King's): encompasses a wide field of experimental medicine, with funded programmes in cardiology, infection and immunity, cutaneous medicine, transplantation, stem cell medicine, genetics and oral health. UOA2 leads the BRC Data Analytics Cluster (**Wolfe and co-Lead (Curcin)**) with funded posts in statistics/data managers, health informatics, social sciences, epidemiology, and health economics. The social science team (**McKevitt**) have developed the PPI component to R&D at Guy's and St Thomas'.

3.2.8 Data Analytics & Big Data: UOA2 make extensive use of linked data sets, nationally, locally, and internationally. For example, the teams regularly work with CPRD, and Lambeth DataNet (1.3M anonymised primary care records) (LDN), with linked Office of National Statistics and Hospital Episodes Data (Figure 9). LDN is linked with other research databases including maternity/neonatal records (BadgerNet), IOPPN's Case Register Interactive Research database of mental health records, and the South London Stroke Register.
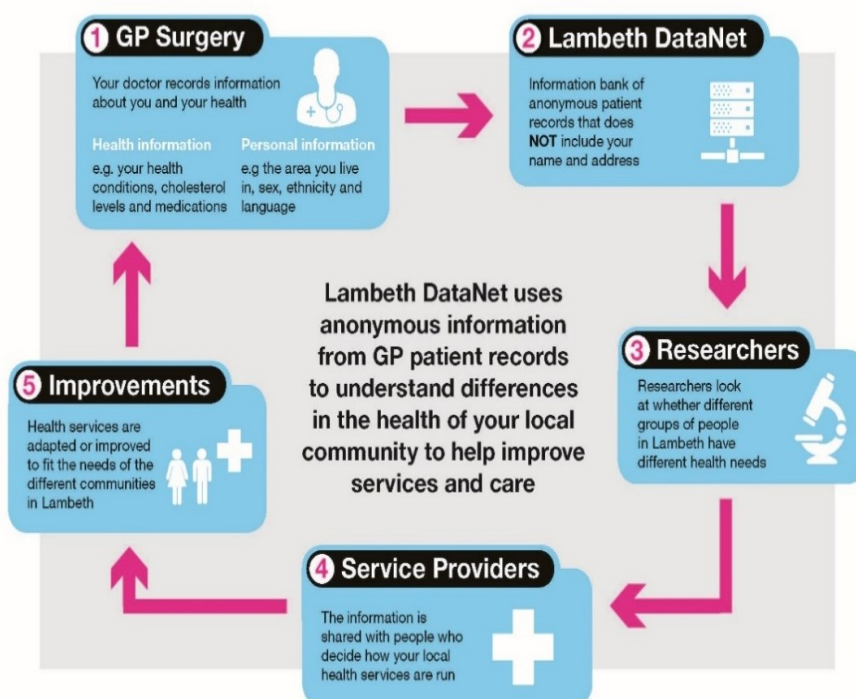
Figure 9: Patient summary of the use of LDN

During the COVID-19 pandemic UOA2 researchers (**Wolfe, Douiri, Curcin**) established a GSTT EHR 'data lake' of clinical data for COVID-19 analytics hosted in an anonymised format at King's through its **High-Performance Cluster, Rosalind**, enabling linkage with research and routine data sets. This is the first step in developing a Trusted Research Environment with our AHSC partners. We have collaborations with the **Artificial Intelligence Centre for Value Based Healthcare (DHSC funded £16M)** in FoLSM in BRC training and research.

3.2.9 Air Pollution Infrastructure and Network

Infrastructure awards to support air pollution research include: MRC Centre for Environment and Health; APEx: An Air Pollution Exposure model to integrate protection of vulnerable groups into the UK Clean Air Programme; NIHR HPRUs in Health Impact of Environmental Hazards and Environmental Exposures and Health. Key research areas supported by the infrastructures include:

- Aerosol Science (**Green**) infrastructures based around the London Atmospheric Observatories or 'Supersites' and Mobile Atmospheric Research Platform
- Environment Toxicology (**Kelly, Mudway, Phillips**)
- Exposure Science (**Barratt**)
- Measurement and Modelling (**Beevers, Fuller**) maintenance of the London Air Quality Network (LAQN), which evolved into the largest urban air quality network in Europe
- Microplastics (**Kelly, Wright**).

3.2.10 Forensic & Analytical Science

UOA2 brings together three laboratories accredited to UKAS Quality Standard (ISO/IEC 17025) for anti-doping (Drug Control Centre), forensic genetics (DNA@King's) and finger mark detection (with City-of-London Police) that provide a unique accredited laboratory footprint, combining world-leading research alongside essential core techniques applicable for use in criminal justice. There are five other laboratories conducting research in crime scene investigation, detection of illicit drugs, waste-water analysis, biomarkers of addiction, genetic, environmental, and forensic toxicology.

3.3 Operational Infrastructure

King's offers excellent infrastructure and support services for research including library and information technology provision with physical libraries on all campuses and web access to a large collection of electronic journals, books and e-resources on and off campus. The library collections include over 1.2M books and e-books, more than 60K electronic journals, over 780 databases and other online resources. Researchers in UOA2 are supported by a dedicated administrative team, King's Research and Researchers Directorate and Human Resources Directorate.

3.4 Infrastructure and Facilities used in Impact

Our infrastructures, facilities and expertise create a vibrant culture to derive impact. Our London team connect researchers with policy makers, and our Service Strategy includes celebrating routes to impact including collaborations with arts organisations (e.g., **McKevitt**). The King's Policy Institute helped develop impact strategies for many researchers including their impact of impact work based on REF2014 (Section 1.5). Funding from the ESRC supported the Policy Institute's Impact Acceleration Account which provides a route through which UOA2 researchers can access policy expertise in funded projects.

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

Collaboration is essential to solving priorities in population and environmental health and we engage through our established UK, EU and increasingly global networks with researchers, policy makers, commissioners, planners of health services, and providers of care. Central to collaborations are views of the public, patients and their families.

Previous Sections described our wide range of collaborative infrastructures and leadership in experimental medicine (**NIHR BRC**), applied research (**NIHR ARC**) with support infrastructures (**NIHR RDS, NIHR CRNCC, NIHR CTU**). In addition, our unique infrastructures in air quality and environmental health (**MRC Centre; NIHR HPRU**), and **King's Global Health Partnerships (KGHP)** provide national and global platforms for our research collaborations. Individual researchers also have collaborations with local, national and global colleagues and research programmes that are highlighted in Section 1 and here.

4.1 Academic Collaborations within King's and Nationally

4.1.1 Local Collaborations

- UOA2 has 28 **honorary clinical research staff in KHP** and Lambeth and Southwark Boroughs (public health) (Professors, Readers, Senior Lecturers). NHS-employed clinical researchers of the Clinical Academic Group in Medicine and Integrated Care at KHP facilitate clinical and experimental medicine collaborations with UOA2 researchers acting as co-applicants on bids, PhD and IAT supervisors and contribute to data analyses and authorship of papers (respiratory diseases/COVID-19; Occupational Health; Stroke Medicine; trials in most clinical directorates). Links with wider London public health and primary care have been with **Dame Clare Gerada**, a local GP who is a visiting Professor and collaborator in a Policy Institute 'Future of London' publication endorsed by the Mayor. **Kevin Fenton**, now London Region Director of public health is collaborating on the multiple long term conditions programme and is a visiting Professor.
- Through **King's Together** funding scheme (via Wellcome Trust Institutional Strategic Support Fund £1M per year to drive new multidisciplinary collaborations, allocated as £20K-100K awards) we developed collaborative programmes with academics from different Faculties, for example patient and citizen engagement (Social Science and Public Policy and SPHES), addressing societal resilience (Policy Institute and SPHES). Tracking public attitudes, beliefs, and behaviour around vaccination (Policy Institute).
- King's Together also pump primed the development of the **Social Science & Urban Public Health Institute.** Its themes include mobility, mental health (**Green**, **Schofield**), multiple morbidities, air pollution (**Garnett**) and urban exclusion (**Guise**). It collaborates with NIHR ARC South London to engage with local publics on priorities for public health, to inform work with local stakeholders such as Groundswell, a south London homelessness charity delivering services across the UK.
- **KCL Science Gallery** connecting art, science, health to drive innovation with **McKevitt** being involved in developing the models of PPI for the Gallery.
- **DRIVE-Health CDT** collaborating with IOPPN, Natural Mathematical and Engineering Science and Dentistry to collaborate with industry partners (£1.3M funding 10-12 students per year) (**Curcin**).
- **Artificial Intelligence Centre for Value Based Healthcare** in FoLSM in BRC training and research and Developing COVID-19 'data lake and warehouse'.

4.1.2 National Collaborations

- **NIHR BRC** analytical support for the NIHR Health Informatics Collaborative in renal transplantation led through GSTT.
- **NIHR Statistics Group** leadership (**Peacock, Bunce**); Membership (**Ayis, Douiri**) of the national network of interested researchers, developing specialist interest groups for NIHR research.
- **NIHR Centre for Engagement & Development: Bearne** is a Senior Research Fellow in Knowledge Mobilisation and Implementation with a focus on translation of research into policy and practice
- **NIHR ARC** multiple morbidity and stroke networks (**Douiri, Wolfe**) that relate to UOA2 research interests.
- **NIHR ARC CrIISTL** (Cross-ARC Improvement/Implementation Science Theme Lead Network) (**Sevdalis**)
- **NIHR ARC MHIN** (Mental Health Implementation Network) (**Littlejohns, Sevdalis**)
- **NIHR RDS** with all university and hospital sites across 3 local CRNs in London and RDS Centres nationally (**Lovell, Reid**)
- **NIHR CRNCC** Board membership and lead for the academic 'Alliance' and Clinical Speciality Leads (**Wolfe**), advising the Network on strategy, emerging technologies and oversight of CRN finances and activity.
- **HDRUK**-London and national leadership role (**Curcin**) and collaborations on Public Health, trials, phenomics with links to specialist groups such as **HDRUK/BHF** Cardiovascular data programme with NHS.

- **NIHR HPRU** with Imperial College and Public Health England; with local Clinical Commissioning Groups, Local Authorities and Public Health Directorates (**Kelly**).
- **MRC-NIHR Phenome Centre** leadership (**Kelly**) delivering access to metabolic phenotyping.
- **DNA and Analytical Science** working with industry partners alongside work for national and local government and bodies (United Kingdom Anti-Doping, the Ministry of Defence, Wales Social Services) to deliver forensic and analytical science services and casework (**Ballard, Syndercombe Court, Wolff**).

4.1.3 National Quality Improvement (QI) Collaborations
- The **National Stroke Audit** (**SSNAP**) (**Douiri, James, Wolfe**) engages UOA2 stroke group with all hospitals in the country delivering stroke care, along with the NHSE Stroke national clinical directors (**Rudd**) and the Stroke Association through the NHS-E Stroke Long Term Plan Board.
- The **National Falls and Fragility Fracture Audit Programme** run through the RCP enables collaboration with clinicians and hospitals nationally (**Sheehan**, Chair Scientific and publications committee; **Whitney**, Chair National Audit Inpatient Falls).
- **Education in Quality Improvement Programme** funded by The Urology Foundation and with the British Association of Urological Surgeons enables urology trainees nationally to develop QI skills and apply them to their training projects (**Sevdalis**).
- **Centre for Implementation Science** runs the UK's annual UK Implementation Science Research Conference (since 2018) and an annual Implementation Science Masterclass (since 2015), which is the largest such course globally – with delegates from over 20 countries attending the latest course (**Sevdalis**).
- **Royal Statistical Society** Quality Improvement special interest group (**Douiri**) Membership (**Ayis, Ashworth**) that relates to UOA interests in Stroke.

4.2 International Academic Collaborations
- **The King's Centre for Global Health and Health Partnerships** includes global health education, global surgery research and KGHP. KGHP brings together academic, health and international development communities to strengthen health systems and improve care quality in Somaliland, Sierra Leone, Democratic Republic of Congo, and Zambia (**Leather, Parmar**).
- **Leather** Co-chaired the Lancet Commission on Global Surgery.
- **EU Horizon 2020** collaborations include a stroke programme, PRESTIGE-AF, evaluating anticoagulation after stroke (**Wang, Wolfe**)
- **PLUS Alliance** (**Green; Kelly**) with Arizona State University and UNSW Sydney on educational course development and social science research.
- **Commonwealth Scholarship Academic Advisors** (**Ayis; Sturzenbaum**).
- **Global Burden of Disease** collaborations (**Shibuya, Wolfe, Kelly**)

4.3 Working with Governments
- **Government reports** on Investigation of Sources and Pathways of Microplastic Pollution into the Marine Environment (**Wright**); Co-Authorship of report on Forensic Genealogy 2020 (**Syndercombe Court**).
- **World Health Organisation** advisor (**Shibuya, Wolff**); air quality guidelines (**Kelly**); and on vaccination acceptance (**Sevdalis**)
- **King's Policy Institute** advisory role for ministers, lobby groups and arm's length bodies.
- All Party Parliamentary Groups on Stroke (**Rudd, Wolfe**), Sickle Cell Disease (**Gulliford**) and Longevity Report (**Ashworth**)
- **Drug Control:** Anti-doping analysis for Rugby and Cricket World Cups, World Swimming Championships (Moscow), 2016 Olympics (Rio de Janeiro), 2018 Winter Olympics (PyeongChang), 2018 Asian Games (Doha). Analytical support and expertise for DNA analysis of UK Grenfell Tower victims (**Syndercombe Court; Ballard**) and the investigation into evidence tampering in the Sochi 2014 XXII Olympic Winter Games (**Syndercombe Court**)

- The Secretary of State for Transport Medical Advisory Panel on Alcohol, Drugs and Substance Misuse & Driving, Panel member; Chair Department for Transport Expert Panel on Drug-Driving; and Expert Advisory Group on Science of the Monitoring Group of the Anti-Doping Convention for the Council of Europe (**Wolff**); Home Office Biometrics and Forensic Ethics Group (**Syndercombe Court**)
- **Guidelines Development:** UOA2 researchers contribute to specialty/service guideline groups nationally for professional groups, NICE and government in: Air quality (**Kelly**); stroke (**Rudd, James, Wolfe**); primary care (**White**), drug-misuse and dependencies (**Wolff**) and forensics (**Syndercombe Court**).

4.4 Collaboration with Industry
- We established industrial collaborations in fields of air quality sensors (Drayson Technologies CleanSpace Tag, Bosch Climo) and pollutant filtration (Airlabs), including technical advice and field testing throughout development phases. Since 2017 we developed a partnership with Dyson Ltd, collaborating on development of wearable air quality sensors, staff training, literature reviews, technical reports, and ad-hoc specialist advice (**Barratt**). **Kelly** sits on the Dyson Personal Care Advisory Board.
- DRIVE-Health CDT has industrial collaborations (NVidia, AIMES, UCB, Imosphere, Takeda), providing studentships and hosting students (**Curcin**).

4.5 Leadership/membership of research funding programmes and bodies:
- **International scientific panel Chairs/members** include Committee on Carcinogenicity (**Phillips, Chair**); Irish Health Research Board: Chair Review Committee to award All Ireland Trials Methodology Research Network (**Gulliford**); Chair, international review committee for the All Ireland Clinical Oncology Research Group (**Gulliford**); Applied Research-Health Research Board Ireland Chair (**Wolfe**); Expert, EU Horizon 2020 Innovation Procurement: Pre-Commercial Procurement and Public Procurement of Innovative solutions (**Sackley**); Member, Norwegian Medical Research Council, HSR Funding Board (**Sackley**); Funding Agency (FRIMEDBIO), Norway (**Sturzenbaum**); Research Foundation Flanders (FWO), Belgium (**Sturzenbaum**); Serbian Ministry of Science review panel (**Curcin**); European DNA Profiling Group (**Syndercombe Court**).
- **Examples of national panel Chair/membership:** include Committee on Medical Effects of Air Pollutants (**Kelly,** Chair); NIHR RfPB (**Armstrong,** National Chair, **Wolfe**, London Chair), HSRUK Board (**Wolfe**, Chair; **McKevitt**, Member), and members of: RfPB London, UKRI Future Leader Fellowships Panel, NIHR Health Services and Delivery Research Dunhill Medical Trust, Prostate Cancer UK, The Stroke Association, British Thoracic Society, Commonwealth Scholarship Commission, UK, MRC, Methodology Research Panel, NIHR Trainees Career Fellowships Panel.
- **Editorial roles in scientific journals and textbooks**; we encourage staff to contribute to peer-review and editorial duties and 38 staff have roles with journals. Co-Editor, Oxford Textbook of Global Public Health, 6th edition, 2015 (**Gulliford**); Founding Chief Editor, BMJ Simulation & Technology Enhanced Learning (**Sevdalis**); Associate Editor, Journals of the Royal Statistical Society (**Ayis, Douiri**)
- **Scientific bodies.** UOA2 researchers are actively involved in their own societies, with 22 having Chair or membership of Councils/boards/working groups.

4.6 Prizes and Honours
- Times Higher Education award 2019 for contributions to the UN Sustainable Development Goals; 2014 Society for Research in Rehabilitation, Distinguished Scholar (**Sackley**); 2019 Fellow, Chartered Society of Physiotherapy (**Sackley**); 2017 "Foreign Talent" Award at Chongqing Institute of Green and Intelligent Technology (CIGIT), (**Sturzenbaum**).
- **Wolff** (MBE), **Wolfe** (OBE). Visiting professors: **Gerada** DBE, **Doyle** CB, **Maryon-Davis** MBE.
- NIHR Senior Investigators (**Peacock, Sackley, Wolfe**).