Institution: University of Oxford

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

1. UNIT CONTEXT AND STRUCTURE, RESEARCH AND IMPACT STRATEGY

Structure

This unit of assessment predominantly comprises two of 16 departments within the University of Oxford's Medical Sciences Division (MSD), with complementary research themes.

The Nuffield Department of Population Health (NDPH: Head of Department *Professor Sir Rory Collins*; total staff 595) was formed in 2013 in order to bring together all of Oxford's main groups conducting research into population health. NDPH is comprised of seven components whose shared **mission is to understand the major determinants of the main causes of death and disability worldwide and ways to prevent and treat them**, with a particular focus on chronic disease. These components work together closely and are: the Big Data Institute (BDI) run jointly with UOA1; the Clinical Trial Service Unit and Epidemiological Studies Unit (CTSU), which includes the MRC Population Health Research Unit; the Cancer Epidemiology Unit; the Health Economics Research Centre; the National Perinatal Epidemiology Unit (NPEU); the Health Services Research Unit; and the ETHOX Centre, incorporating the Wellcome Centre for Ethics and Humanities, which spans UOA4, UOA28 and UOA30. NDPH is located on the Old Road Campus in Headington, Oxford.

The Nuffield Department of Primary Care Health Sciences (NDPCHS: Head of Department *Professor Richard Hobbs*; total staff 314) was created in 1998 and expanded rapidly after 2011. NDPCHS's **mission is to reduce health inequalities through improved care and better quality of life from research delivered around patients' first point of contact with health services**. Its research themes encompass the study of a range of major diseases and risk factors contributing to poor health. Five themes of impact (cardiovascular/metabolic health, health behaviours, infections and acute care, evidence-based medicine, and medical sociology/health experiences) are complemented by five cross-cutting themes (Big Data, clinical trials, digital health, global health and health policy/systems). NDPCHS is located in the Radcliffe Observatory Quarter in central Oxford.

The distinctiveness of the UOA2 research environment in Oxford lies in:

- rich research resources, which include some of the world's largest prospective observational studies, randomised trials, and research databases of routine healthcare data;
- multidisciplinary teams combining the best of quantitative methodology with social sciences, ethics, health policy and health economics;
- commitment to promoting career progression for early and mid-career researchers;
- skills required to design, set up, and run research studies rapidly and at lower cost;
- investment in world class infrastructure and facilities to support these programmes; and
- secure and diverse funding streams allowing flexibility and responsiveness to public health needs.

Achievements during the census period

For REF2014 we set out six strategic objectives, which included three to **establish and maintain research infrastructure**, and three to **facilitate multi-disciplinary and team science**. As outlined below, we have made significant progress in these.

By 2014, UOA2 had yet to benefit fully from the expansion of staff and research infrastructure initiated by Professor Richard Hobbs in 2011, or from the re-organisation of population health groups into NDPH under Professor Sir Rory Collins after 2013. During this REF period, both departments have grown rapidly by expanding facilities, infrastructure and staff, and built research critical mass to have a greater impact across a wide range of healthcare domains.

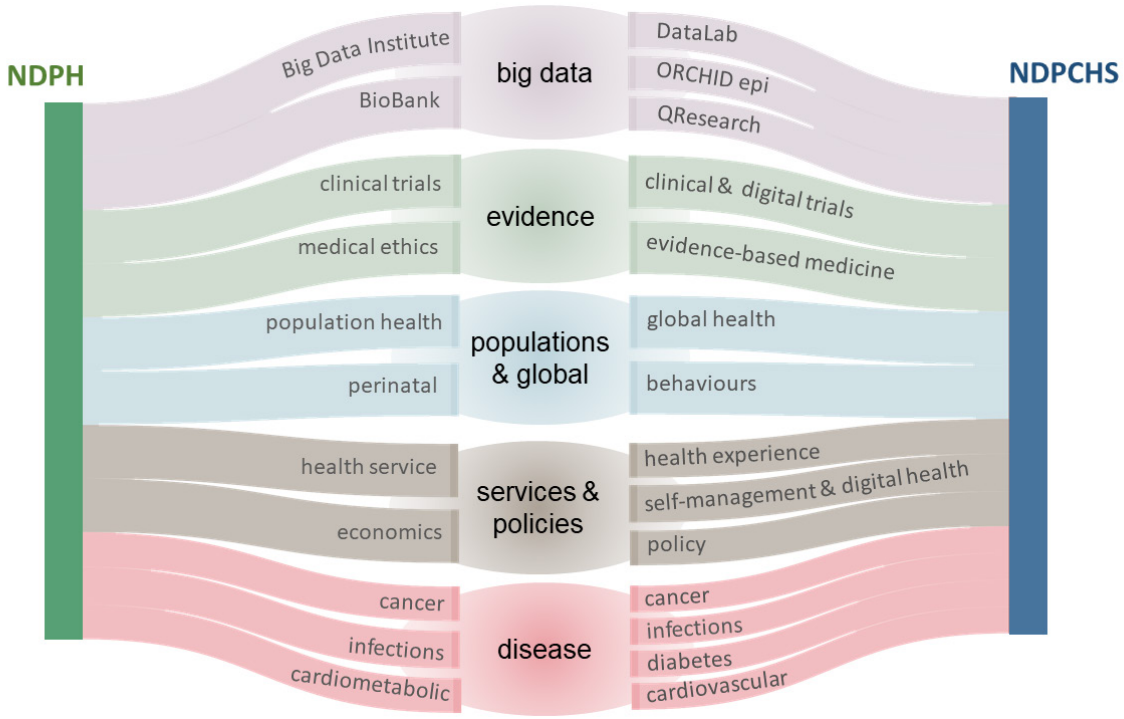


Figure 1: **Synergy between the research aims, activity, major units and expertise of NDPH and NDPCHS. Other research clusters exist in similar themes: the lists are not exhaustive.**

For example, as part of a joint venture with UOA1, in May 2017 we completed the Li Ka Shing Centre for Health Information and Discovery in a new £46M building adjacent to NDPH's Richard Doll Building on the University's Old Road Campus (ORC). This building provides a bespoke environment for Oxford's new BDI and brand new accommodation for a total of 310 NDPH staff and students. Similarly, NDPCHS moved into a restored landmark building (the £14M Radcliffe Primary Care Building in the Radcliffe Observatory Quarter, ROQ) in 2016. The two Departments now have a combined space of 17,702 m^2.

As a result of the new facilities and growth in research infrastructure, the headcount for the departments has expanded by 44% over the 7-year census period. Major achievements in the census period to meet our REF2014 strategic objectives include:

Establish and maintain research infrastructure

- **Substantial investment in new buildings** including the £46M Li Ka Shing Centre for Health Information and Discovery (4,700m^2) and the £14M Primary Care Building.
- **Renewal of NIHR infrastructure funding:** including the Oxford Biomedical Research Centre (£114M, 2017), with the largest aggregate (and absolute) funding uplift in the UK, the NIHR School for Primary Care Research (£37M, 2015), and the new NIHR Oxford & Thames Valley Applied Research Collaboration (ARC, 2019).
- **Internationally distinctive research infrastructure:** Leadership of international biobank studies in the UK (UK Biobank), China, and Mexico (total 1.2M participants), 3 NIHR-registered trials units.

Facilitate multi-disciplinary and team science

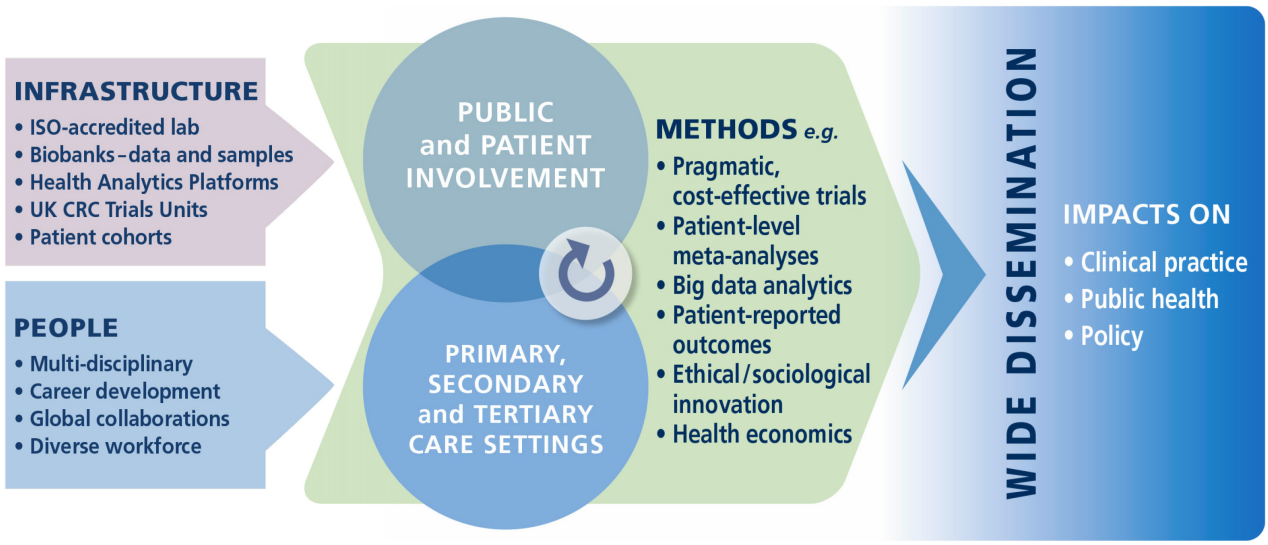
- **NHS Links** strengthened by designation of Oxford's Oxford Academic Health Centre (2020).
- **Rapid growth in research funding:** Average **annual grant income increased by 46%**, from £37.8M in REF2014 to £55.3M in REF2021**.**
- **Leadership in major COVID-19 projects** with global impact, including the RECOVERY trial that identified the first effective treatment (dexamethasone) for COVID-19 *[REF3:30RECOV-2]*

- **Rapid staff expansion:** Research staff **increased by a factor of 1.7** (from 190 to 318) during the census period, including 14 new professors recruited externally. Growth is also reflected in the **144 submitted researchers (134.3 FTE)**, a factor of 2.7 higher than 53 (47.7 FTE) in REF2014 (Category A).
- **Substantial growth in doctoral programmes: Over 2-fold increase** in doctoral training through initiatives taken by UOA2 departments, one of our key priorities in REF2014.
- **Equality and diversity:** new recruitments from doctoral students (62% women) to senior strategic appointments (50% women); increased proportion of BAME staff (from 16% to 20%).
- **National and international recognition of personal distinction:** MBE, OBE, CBE, FRS (x2), FMedSci (x6), FAcSS, and 13 NIHR Senior Investigators.

Research and impact strategy

We aim to provide excellent support for research through state-of-the-art facilities, and excellent training and support for career development to encourage a flourishing research environment. Both before and during the census period we have created (a) **internationally distinctive research infrastructure** in the shape of research cohorts, sample collections and access to very large databases of routine healthcare data; and (b) unique expertise in the use of **innovation to streamline study design**. These components provide the necessary ingredients for creating a wide range of distinctive research studies in **various healthcare settings,** engaging communities, and employing **diverse study designs**, the results of which enable **major impacts on clinical practice and on public health** (Figure 2).

Figure 2 Components of research strategy towards our overall mission to have impact in clinical practice and public health.



Strategic aims set in REF2014 and future plans

Our progress with the six objectives set out in REF2014 has helped to shape our current research environment in UOA2, and we are retaining these six objectives (1-6 below) whilst adding three ambitious new objectives that will help us accelerate the health impact of our work. For the six strategic objectives set out in 2014, our achievements during the census period provide examples of how UOA2's environment and supporting facilities and policies have enabled distinctive research capabilities. Our objectives help us pursue three broad aims:

Building infrastructure

1. Establish new infrastructure for large prospective cohorts
2. Establish new infrastructure for randomised trials
3. Conduct meta-analyses and systeatic reviews

Undertaking multidisciplinary team science

4. Establish and strengthen collaborations to support research excellence
5. Facilitate cross-disciplinary research to exploit new technologies
6. Achieve excellence in staff development and training

Accelerating impacts (new)

7. Enhance healthcare delivery and policy
8. Enhance communication and availability of research results
9. Innovate for greater public and patient involvement (PPI) to improve the relevance and quality of our research

Objective 1: Establish new infrastructure for large prospective cohorts

Achievements in census period: We have aimed to capitalise on our access to uniquely large and well phenotyped cohorts by building additional research infrastructure to support Big Data analytics within those cohorts.

The University's new **BDI** brings together researchers from both NDPH and the Nuffield Department of Medicine (UOA1). The BDI has rapidly established a key role in driving forward the UK's research agenda on the use of routine healthcare data and digital innovation. The BDI is now a substantive site in **Health Data Research UK (HDR-UK)** and BDI scientists lead the **NIHR Oxford Biomedical Research Centre Clinical Informatics and Big Data** theme (total funding £8M). The new building encourages collaborative and inter-disciplinary working across the medical sciences and with engineering, computer science and statistics facilitated by co-location with BDI scientists involved in genomics, image analysis, infectious disease surveillance, digital phenotyping, and the acquisition of detailed hospital electronic healthcare records for research.

NDPH provides the scientific leadership for the **UK Biobank prospective cohort** (n=500,000) and secured the renewal of the government and charity core funding (£32M; 2017-22) and other grants for imaging (£43M), genetic/other assays (£33M) and IT (£20M), as well as industrial investment in genetic and other assays (equivalent ~£280M). NDPH also provides scientific leadership to the UK's new **5M person cohort study**, **OurFutureHealth,** which will support the integration of genomic medicine in the NHS.

Our own large prospective studies have also continued to develop, with additional follow-up and innovative assays (including genomic, metabolomics and non-blood materials, e.g. faecal samples) and have leveraged funding from partner organisations (Section 3).

We have invested in primary care databases, including **QRESEARCH** (1,500 practices, EMIS, linked to hospital, mortality and cancer registry), the **OpenSAFELY** data-lake linked to 17m patient records (July 2020, but expanding rapidly), and the **ORCHID** digital platform for epidemiological studies, sentinel disease surveillance (including COVID), and pragmatic trials. The University of Oxford's environment facilitated responsiveness that was pivotal to our early and detailed national initiatives in response to the COVID pandemic and is sustainable since our environment would allow similar types of responses to be replicated in future pandemics (Box 1).

Future plans: The main anticipated area of development for Oxford's large prospective studies will be innovation to meet the analytical and computing needs of health care studies utilising Big Data. **Cloud-based computing** will allow sharing of next-generation sequencing genetic data, and will develop computing capacity within the BDI. A new **Institute for Applied Digital Health** will be established and will involve collaborations with all accredited GP software suppliers and a range of other data repositories and stakeholders. The Institute will develop high dimensional digital research platforms for clinical trials in general practice, disease surveillance, multidisciplinary clinical prediction modelling and drug safety research.

Box 1: Responsiveness to COVID-19 enabled by established infrastructure

Work led by NDPH on the UK Biobank study created a nationally representative sample of 20,000 people who provide records of COVID-19 symptoms and regular blood samples in which coronavirus antibodies are measured in Oxford's Target Discovery Institute (UOA1). This study has already provided **reliable evidence on prevalence of infection and immunity** and changes over time, which informs government policy. Digital innovation allowed the development of the national ORCHID **COVID surveillance platform**, now involving 1800 general practices, provides daily data; the **OpenSAFELY** secure analytics platform with 17M electronic health records in the NHS by July 2020 (and rapidly growing).

The **Randomised Evaluation of COVID-19 Therapy (RECOVERY)** trial is the national urgent priority platform for repurposed medicines in hospitals. NDPH harnessed its unique and extensive trials infrastructure to create a multidisciplinary trial team to recruit its first participant 9 days after the protocol was finalised, and 10,000 participants were recruited within just 8 weeks *[REF3: 30-RECOV-2]*. By July 2020 RECOVERY had identified the first effective treatment against COVID-19 by showing that dexamethasone reduces risk among patients receiving oxygen therapy (NEJM 2020), and had also showed that hydroxychloroquine (NEJM 2020) was not effective. NDPH scientists (Peto, Pan) were also responsible for writing the protocol in the parallel WHO **SOLIDARITY** trial (NEJM 2020, first authors), an interim analysis of which, in July 2020, confirmed the RECOVERY results for hydroxychloroquine and lopinavir, and demonstrated that remdisivir was of little value.

The **Platform Randomised Trial for Interventions against COVID-19 in Older People (PRINCIPLE)** is the UK urgent priority platform for repurposed medicines outside of hospitals, as of summer 2020 testing azithromycin and doxycycline in people with COVID-19. This trial is innovative because it has digital recruitment and follow up is entirely online, with a central recruitment option enabling any eligible community patient to participate from any location.

Objective 2: Establish new infrastructure for randomised trials

Achievements in census period: The main way in which the research environment has supported trials units in UOA2 is to have encouraged the **evolution of digital innovation and streamlined design** to improve research efficiency. Our portfolio includes vascular, metabolic and perinatal medicine and infectious diseases. Much of this has benefited from collaborations (Section 4). For example, our collaboration with HDR-UK, a major programme of work (the '21st Century Clinical Trials' theme) is using methodological innovation to facilitate **large-scale recruitment and follow-up**. Our collaboration with NHS Digital in the 15,000 patient **ORION-4** trial allows **use of Health Episode Statistics data** to assess the number of potentially eligible patients, identify and invite them to screening clinics, and to collect endpoint data. We have been able to use our nationally-unique expertise and infrastructure to design and recruit into a national platform trial for treatments of COVID-19, namely **RECOVERY** (Box 1 and REF3: 30RECOV-2), which is assessing treatments for COVID-19 in hospitals. In the Primary Care Trials Unit a period of substantial growth in research capacity (from 12 to 80 staff, now running 59 trials) underpinned the **PRINCIPLE** trial (Box 1), in which patients can participate in the trial entirely online.

Future plans: Our UOA has pioneered the **streamlined design of trials**, and the success of such methods in the RECOVERY trial has yielded funding to allow RECOVERY to continue long-term and expand its scope. Such developments will be catalysed by work in the **NHS Digi-trials project** within the Oxford HDR-UK's 21st Century Clinical Trials theme led by NDPH, which will develop new software to support trial management systems and electronic health records in order to **reduce trial development time and costs**. New trial methodologies in the primary care setting will use digital methods and existing clinical databases for general practice. This will utilise the **ORCHID** platform in NDPCHS and build on the novel design of the PRINCIPLE platform trial

infrastructure with response adaptive randomisation and the capability for adding in and dropping arms while the study is in progress, allowing a **step change in scale** for the conduct and long term follow up of large pragmatic trials to reduce trial cost and increase reach.

Objective 3: Conduct meta-analyses and systematic reviews

Achievements in census period: We benefit from secure and flexible core funding from the MRC, BHF and CRUK, and this has allowed the creation, over some decades, of several large collaborations of trialists who contribute **individual patient data** (and updates or enhancements) to meta-analyses. In the census period this led to major publications on the treatment of breast cancer from the **Early Breast Cancer Trialists' Collaborative Group (EBCTCG),** which involves >500 trials among >600K women, including papers on the effects of bisphosphonates on bone metastasis and survival (Lancet 2015); benefits of aromatase-inhibitors over tamoxifen (Lancet 2015) and aromatase dose intensification of chemotherapy (Lancet 2019) *[REF3: 05BRCA]*, from the **Cholesterol Treatment Trialists' (CTT) Collaboration** (28 trials, >170K participants) on increasing the intensity of statin therapy and extending the range of patients treated e.g. in the elderly (Lancet 2019) *[REF3: 09STATINS]*, and from the **Blood Pressure Lowering Treatment Trialists' (BPLTT) Collaboration** (>50 trials, 350K participants), including a BPLTTC study showing that risk-based treatment is more effective than treatment based on blood pressure thresholds (PLoSMed 2018). In parallel, the **Centre for Evidence-based Medicine (CEBM)** has helped to build capacity in Oxford as well as nationally (and internationally), and has coordinated a wide range of systematic reviews. For example, it hosts the Cochrane Tobacco Addiction Group (TAG), which led a suite of 83 published reviews that have been cited in at least 87 guidelines worldwide, and during the pandemic the **CEBM COVID-19 Evidence Service** has delivered widely cited evidence based data.

Future plans: In response to the need to conduct meta-analyses of individual patient data through data sharing platforms (i.e. without a local copy of the data), we continue to develop expertise in conducting analyses that involve collaboration with multiple platforms. An early example is the CTT's work on the **side-effects of statins** using detailed individual patient data from large statin trials, which has involved collating over 500 data files and 23M data items: we expect to report results of these analyses shortly. The EBCTCG will also report analyses of **newer breast cancer drugs**, including Herceptin (trastuzumab), as well as analyses that inform the development of personalised medicine. Work is planned to improve the evidence base for the **management of long term conditions**, for example with a suite of reviews aimed at reducing inappropriate polypharmacy in multimorbidity, benefits of low salt diet in heart failure and self-monitoring of blood pressure. The new Social Prescribing Research Group, which involves an interdisciplinary network of researchers and stakeholders from NHS primary care, the arts, humanities and cultural sectors, will explore the **role of social prescribing**.

Objective 4: Establish collaborations to support research excellence

Achievements in census period: We achieved substantial growth in the number and range of collaborations in the census period. Our research environment, with its co-location of researchers, resident expertise in Big Data and innovative research methods, and access to data and flexible funding allows us to constitute research collaborations rapidly in response to health needs. This was illustrated particularly by the rapid assembly of novel collaborations in response to the challenge of COVID-19 (Box 2).

Oxford has long-standing expertise, developed with the support of the University's Research Services team [IES-4.1], in sponsoring and conducting large randomised trials in collaboration with **pharmaceutical partners**. During the REF period we have diversified our partnerships, in part enabled through investment in computing infrastructure, and now have collaborations with **Boehringer Ingelheim** (EMPA-KIDNEY trial) and **Novartis** (ORION-4 trial), with total funding >£150M, and with **AstraZeneca** and **Regeneron** in the Mexico City Prospective Study (funding genotyping and exome sequencing in 150K participants). 6.8% of papers published by our submitted researchers during the REF period had a co-author from industry (source: SciVal).

A partnership has been established with **EMIS health** (provider of clinical computer systems for >55% of GP practices nationally to develop a pragmatic trial platform (ORCHID) and to develop the QResearch database (~1,500 GP practices) and implement multiple risk prediction models (e.g. QRisk, QCovid) into routine practice. Other collaborations that are pivotal for delivering high quality research in primary care are those with **UK-based primary care departments** through the NIHR **School for Primary Care Research** (partnership with the 7 other leading UK primary care departments, investing £5M annually) and the **NIHR Oxford and Thames Valley Applied Research Collaboration** (local NHS Trusts, Public Health departments, and University departments that deliver applied research and implementation projects).

Future plans: For research into digital innovation in primary care, including patient self-management, the new **Institute of Applied Digital Health** will bring together a unique collaboration of major interests related to digital health for primary care. The BDI plans to leverage its collaborations within the UK (e.g. HDRUK), with NHS Digital, and with funding partners to **improve the efficiency and speed of recruitment into both randomised trials and observational studies**. The benefits of these features have been highlighted by the success of the RECOVERY and PRINCIPLE trials (Box 1).

Box 2: Collaborations assembled rapidly to fight COVID-19

In response to concern that patients with life-threatening conditions were staying away from hospitals during the COVID-19 pandemic. We collaborated with **NHS Digital** to use a rapid and novel method of curating a dataset of patients presenting with acute coronary syndromes to hospitals in England. The results, which were published in the Lancet (July 2020), showed a substantial reduction in the numbers of patients presenting to hospital with such syndromes during the first lockdown, and were presented to SAGE and to the Chief Executive of the NHS.

In the primary care setting we created the **OpenSAFELY** secure analytics platform without initial funding in a five week period to deliver urgent results during the COVID-19 pandemic. It is a collaboration between Oxford, the electronic health record group at the London School of Hygiene and Tropical Medicine, electronic health record suppliers, notably TPP and EMIS, working with NHS England and NHSX. The collaboration includes software developers, clinicians, and epidemiologists, all pooling diverse skills and knowledge to deliver high performance, highly secure and accurate health data analytics, using modern open software development techniques. The first analyses were published in Nature (July 2020) and identified which patients are most at risk of death in hospital from COVID-19, with more accuracy than any previous analyses.

Objective 5: Facilitate cross-disciplinary research to exploit new technologies

Achievements in census period: A notable feature of the UOA2 environment is the way in which cross-disciplinary collaborations are encouraged by (a) the recruitment of a wide range of skillsets within the BDI a joint endeavour across UOAs 1 and 2 which facilitated collaboration, e.g. between infectious disease and chronic disease population scientists, in the RECOVERY trial (Box 1), but also more generally between statistical genetics, epidemiology and data science in general; (b) the close proximity, on the Old Road Campus, of the BDI, the Oxford Institute of Biomedical Engineering and the Wellcome Centre for Human Genetics; (c) the synergy of major health economics groups in both departments (led by *Petrou* in NDPCHS, and the Health Economics Research Centre in NDPH) with experience in assessing cost-effectiveness and other health economic questions in our randomised trials and other epidemiological studies. 22% of funded research projects started during the REF period had collaborators within Oxford from another UOA, and only 17% of our published papers did not have any author outside the University of Oxford.

Notable cross-disciplinary work completed in the census period has included investigation of healthy and sustainable diets *[REF3: 03DIETS]* and collaborations between groups studying cardiovascular, metabolic and infection disease with IBME **(Box 3)** to develop **near-patient test systems e.g. for monitoring of COPD**. Oxford's work in this area (including work in diabetes self-testing *[REF3: 10DIABETES]* and self-monitoring of blood pressure) has resulted in sustained changes in clinical practice.

Cross-disciplinary work on **improving weight management** *[REF3: 07WEIGHT]* involved a programme of clinical trials, systematic reviews, economic modelling and embedded qualitative research which directly contributed to NICE and Public Health England guidance and led to change in Government and NHS policy on weight management.

Box 3: Cross-disciplinary work with Engineering (UOA12)
There is a long-term and productive collaboration between researchers in NDPCHS and Oxford's Institute of Biomedical Engineering. Work has included evaluation of **mobile-phone based telehealth systems to support patients with type 1 diabetes** in managing their insulin treatment. More recent work has included using the mobile phone systems to **help people with type 2 diabetes adjust their insulin and tablet treatments**. Systems have been developed to help people with other conditions including **chronic obstructive lung disease**, and to provide support through mobile phones to patients being treated in resource poor settings.

I**nnovation in trial methodology** has also arisen through the creation of in-house expertise from across a wide range of disciplines and has been critical in enabling a rapid response to the COVID-19 pandemic (e.g. in the **RECOVERY** and **PRINCIPLE** trials). The opening of the BDI has led to additional innovations in data science, including the use of routine healthcare databases (e.g. **ORION-4**), analysis of imaging, genetic-epi combinations and activity monitoring.

Future plans: We will expand cross-disciplinary approaches, examples include: (i) additional partnerships with industry (e.g. with software engineers, molecular geneticists and imaging specialists) for cohort-wide bioassays and imaging of our large biobank and prospective studies, (ii) multidisciplinary studies of how digital health technologies 'really work' in the primary care setting using theoretical frameworks; and (iii) implementation studies with the Applied Research Collaboration to investigate how telemonitoring and self-management of hypertension and pregnancy hypertension have worked, notably including rapid implementation due to the COVID-19 pandemic.

Objective 6: Achieve excellence in staff development and training

Achievements in census period:
UOA2 has invested heavily in training during the census period. One of the key priorities over the census period was to achieve **growth in our doctoral programme.** Our initiatives included improved communication about the opportunities for study in Oxford, expansion of the pool of supervisors and associated projects, and the provision of scholarship funding. We have succeeded in this objective, with an average of 21 students per year completing DPhils in the census period (up from 9 per year in REF2014 – a **more than 2-fold increase**). We have reinforced the strength of our **clinical academic training**, with a total of 12 Academic Clinical Fellows currently.

We have supported 44 individuals to develop their careers through **externally-funded fellowships** (including 7 Wellcome Trust, 7 BHF, 15 NIHR, and 4 MRC fellowships), and 3 recent doctoral graduates have gained NIHR SPCR Launching fellowships and are now pursuing post-doctoral studies in Oxford. Similarly, our Academic Clinical Lecturers have been outstandingly successful, with 4/5 remaining in research, 2 with NIHR Advanced Fellowships, 2 gaining promotion to Associate Professorships. We have also created **departmental fellowship programmes** (17 awarded to date, with annual budget £0.25M) and **pump-priming schemes** to support career development (with 30 grants awarded to 14 women and 16 men).

Future plans: We seek to refine our doctoral training further. We also plan expansion of MSc taught programmes, with the aim to ensure that there is a continuous influx of young researchers who not only bring fresh ideas and encourage vitality in our research programmes. Examples include: a new **MSc in Clinical Trials** in 2021, which has just commenced in conjunction with the European Society of Cardiology's 'European Heart Academy' distance-learning programme (5 scholarships), and new Masters in **Global Healthcare Leadership** in 2021 and **Applied Digital Health** in 2022. Future plans are described further in Section 2 below.

(NEW) Objective 7: Enhance healthcare delivery and policy

Future plans: We will **diversify the beneficiaries of our research**, thereby **expanding our reach**.

Actions to date: Examples of healthcare policy work to date include: (i) work planned by the Policy Research Unit in Maternal and Neonatal Health and Care, part of NPEU, which will extend an existing stream of work focussed on how maternity services are organised and deliver care *[REF3: 01MATERN]*, addressing reasons for the higher maternal and neonatal mortality and stillbirth rates amongst BAME populations; (ii) influencing health delivery through how NHS patients gain early access to novel treatments: for example, in our work on the ORION-4 trials, we have engaged with Novartis and the NHS to facilitate rapid uptake of positive results at a discounted cost and will explore how this model could be extended to other treatments.

(NEW) Objective 8: Enhance communication and availability of research results

Actions to date: Advances in knowledge must be communicated and research data made available for sharing if research studies are to have maximum impact. We have appointed **new communications and public engagement staff** to ensure that new research is showcased both in national and international media. Examples of recent successes include dissemination of information and results from the Randomised Evaluation of COVID-19 Therapy (RECOVERY) trial (over 13,000 items of media coverage) *[REF3: 30RECOV-2]*.

Future plans: We have played a leading role in discussions with funders (e.g. MRC, Wellcome and CRUK) about how to ensure that data-sharing policies for studies conducted in collaboration with scientists from lower and middle-income countries are equitable. We have led discussions with NHS Digital to ensure that datasets incorporating NHS data can be sub-licensed to approved researchers (legal barriers to such sub-licensing are currently a major barrier to data-sharing). We have played a pivotal role in the development of all of the UK Biobank data systems as well as the design for the tender of the UK Biobank data analysis platform funded by Wellcome Trust and the MRC, which will manage access to whole genome sequence data on all 500,000 participants.

(NEW) Objective 9: Innovation in public and patient involvement to improve research

Future plans: Currently there are a variety of approaches to patient and public involvement for primary care research. In the primary care setting these are led by a network that includes the Applied Research Collaboration, Biomedical Research Centre and School for Primary Care Research. Plans for future work in this area include:
The **Working Together Operational group**: collaboration of organisations across the Thames Valley that work together to support improvements in patient, carer and public involvement in health care, research and education.
Priority Setting Partnerships, most recently in Obesity and weight related research, in Heart Failure, Hypertension and Diabetes in Pregnancy. These initiatives ensure that patients and the public are involved in research from the beginning, setting the agenda as well as being involved in the actual development, design and delivery of it.

We will expand and consolidate the bespoke approaches our groups have already developed for PPI and help other research groups to benefit from this experience and expertise. Departments provide central resources (for example, the NDPH funds a **0.5 FTE PPI coordinator**), and advice (for example, we have established a **Public Advisory Panel** with wide representation (25

members, of which 11 are female) that provides advice and guidance on research, from initial study proposals to ways in which research findings may be used to influence policy and improve health). Future plans include research into PPI itself, e.g. for different types of studies. Successes so far include the **PRU-MHC: Policy Research Unit in Maternal Health & Care** in the National Perinatal Epidemiology who maintain an active stakeholder group, including public members, voluntary and third sector organisations from across the maternity sector.

Research Integrity

UOA2 departments put great emphasis on research integrity. All contracts for funding of research projects are managed by Research Services including ethical review. All research staff are now required to undertake an **online course on research integrity**. To maintain confidence in research independence, it is strongly recommended in NDPH that staff members do not accept personal honoraria or consultancy from pharmaceutical companies, and that they do not own shares in drug companies (other than through unit trusts or similar investments). Personal consultancies for other sectors, giving advice or assistance, can be a valuable route to impact but are expected to be reviewed by Oxford University Innovation [IES] to ensure compliance with University policies.

Open Research

We are committed to **open science and the sharing of research data**. During the census period UOA2 studies have shared over 200 datasets with external research groups. Data sharing of our large biobank and prospective studies is governed by specific data access policies, and we plan to move to cloud-based systems, in particular to manage the need for large (terabyte) amounts of storage to process genetic sequence data. Through this infrastructure and the ways in which our research projects draw on it, we contribute to advancing **open and reproducible research**. Our desire that all clinical trials meet the highest standards of transparency has also underpinned our work leading to the AllTrials initiative *[REF3: 06TRIALS*], led by *Goldacre* and now a coalition including the BMJ and the Cochrane Collaboration, supported by organisations worldwide.

The University's provision of the Oxford Research Archive (ORA) [IES 2.4] is helping to increase the fraction of our work available with open access. Over 1,000 deposits of papers were made available via ORA in 2019, and overall 88% of our papers were open access by one or more routes, up from 62% in 2014.

2. PEOPLE

Background: We are strongly committed to the career development of academic and research staff and to establishing an equitable and supportive work environment. Staffing strategies are designed to support the development and sustainability of the many different types of research activity (including both clinical and non-clinical) and in the wide range of diseases and themes that are described above.

We provide a stimulating working environment, with a strong culture of research integrity, which offers support and encouragement for all members of staff, irrespective of their seniority, and irrespective of whether they are a researcher or professional support staff. We aim to ensure that staff are supported in ways that allow each to achieve their maximum potential. We are committed to ensuring that staff are happy with their work-life balance, and actively supported when they have to undertake caring duties or experience illness or bereavement. A survey of staff in 2018 indicated a **very high level of staff satisfaction**, with 90% of responders (90% women, 96% men) agreeing with the statement 'Overall, I am satisfied in my job', and 94% (94% women, 100% men) agreeing with the statement that 'I would recommend working at the University of Oxford to a friend'.

During the census period we have improved our communication policies and methods to ensure that all staff are aware of activities, policies and opportunities. In NDPH, for example, a new Director of Communications and Public Engagement has enhanced internal communication channels through the intranet and regular all-staff emails and is overseeing the design of a new website with integrated intranet.

In this section we describe how we advance equality; support all staff to reach their potential; develop research careers with particular actions; support clinical staff; and facilitate succession in leadership. We then describe our training for doctoral students towards the degree of DPhil.

Advancing equality, diversity and inclusion

- **Flexible and part-time working:** We have clear and well-communicated policies on flexible working, and support such working provided that it is compatible with an individual's role and is agreed by their line manager. Overall, around one third (31%) of staff work part-time (27% in NDPH, 37% in NDPCHS) and 77% reported working flexibly in the last survey. We provide support for staff and research students with caring responsibilities (e.g. Box 4) by providing extra support for conference attendance or other necessary travel. NDPH was the first Department in the MSD to offer a part-time DPhil.
- We provide support for staff and research students **returning from periods of leave** (including parental leave or ill health) and/or who are managing **long-term illness**. Depending on the circumstances, we draw on advice from the University's Occupational Health Service, implement a phased return to work or other adjustments advised by OHS, enable short- or long-term flexible working arrangements (e.g. changes in working hours) and/or periods of unpaid leave or career break. Staff returning from caring leave can access grants of up to £5K (up to £10K in exceptional circumstances) from the Returning Carers Fund to help them overcome barriers they are facing returning to the workplace. We have **awarded £56K to returning carers through this fund since 2016.**
- Both NDPH (2015, renewed 2019) and NDPCHS (2014, renewed 2017) have **Athena SWAN silver awards**, recognising the action we have taken to establish a strong culture of inclusivity and equal opportunity. Specific actions include for example, in response to a lack of information about childcare provision on the Old Road Campus, where NDPH is located, action from the Department's survey resulted in the **provision of an extra 100 nursery places on the Campus**. We have **sponsored 12 nursery places** (worth £1,000 each) since 2017. We support staff to secure no-cost extensions from funders following maternity leave and have added new breastfeeding facilities.
- UOA2 has also a commitment to ensuring equality of opportunity for BAME researchers: of those with known ethnicity (>90% of staff) the proportion identifying as BAME **increased from 16% in July 2013 to 20% in July 2020.** Improvements in specific areas of provision that advance equality and diversity are described in corresponding sections below.

Box 4: Junior researcher to Professor

Professor Sarah Wordsworth (NDPH): Sarah is a health economist and has been in Oxford since 2003. She has progressed from junior researcher to Professor in 18 years including two periods of parental leave. Sarah writes:

"The department has a culture of flexibility. I never feel uncomfortable if I need to go to a school concert or take annual leave to help on a school activity, as I'm trusted to use my time valuably. People also avoid setting meetings before 10am and after 4pm, so as not to disadvantage people who start later due to long commutes or the school run. Whilst in NDPH, I have managed to secure good grants with the support of a great finance and grants team. I am fortunate to be engaged in exciting collaborations with universities across the UK and abroad."

"I have also had good promotions along the way due to a lot of support and encouragement from the Department and clear advice on re-grading. I am supported in taking on more responsibility alongside my research, and I am on various interesting committees at the Departmental, College, National and International level, as well as being involved in student and staff mentoring and supervision. Finally, for me the best thing about working in NDPH is feeling that I am able to pursue my intellectual interests with full departmental support."

Helping staff to achieve their full potential

As well as creating the conditions that promote general wellbeing we have policies designed to encourage **personal and professional development** and create a stimulating environment. *Performance and Development Reviews (PDR)* underpin staff development: academic, research and professional staff are all strongly encouraged to undergo PDRs annually with their line managers: in the 2018 staff survey in NDPH 4/5 of respondents indicated that they had completed a PDR, and 86% reported finding it useful. This scheme invites staff and their managers to consider all of the following provision:

- *Mentoring programmes* are open to staff at all grades and aim to provide support for career development that is independent from line managers. In NDPH, for example, there have been 78 pairs of mentors and mentees during the census period. In NDPCHS there is a peer mentoring system to supplement standard mentoring initiatives to facilitate exchange of experience and career plans. Research staff are also encouraged to participate in the MSD **mentoring scheme** (accessed by 52 mentees and provided nine mentors), or seek external mentoring through the AMS or NIHR schemes. The University also offers the **Oxford Senior Women's Mentoring Network**, to encourage senior women to explore their leadership potential: in UOA2 14 women have been mentees and nine have been mentors as part of this network during the census period.
- *Training* is an integral part of our culture, and we pay particular attention to ensuring equality and diversity. Departments have **Training and Diversity Facilitators** responsible for ensuring that all professional support staff have the same access to training as research staff, irrespective of gender, and where possible courses are provided in-house.
- *Leadership training:* 101 staff (76% women) have undertaken management/leadership training during this period. Funding is available for staff approaching senior posts to undertake leadership training. UOA2 departments have supported eight women to attend the Women Transforming Leadership programme at the Saïd Business School, and also eight other staff to attend leadership programmes.
- *Sabbatical leave* is available and encouraged for all academic staff (one term for every six).
- *Re-grading, recognition and reward*: There were over 200 successful applications for re-grading in the census period. There is a separate Reward and Recognition Scheme for particular outstanding contributions, and during the census period: 140 individuals were nominated, and 136 (96%) were successful.
- *Promoting job security*: We have specific **policies designed to improve job security**. All staff contracts are reviewed after four years and staff are moved to either permanent contracts (support staff) or open-ended contracts (research and other academic-related staff) if the expectation is that work and funding will continue for the foreseeable future: **around 60% of our independent research staff are on permanent or open-ended contracts**. Support for 'bridging' between research posts is devolved to departments, e.g. through a competitive fund (NDPCHS) or at the discretion of the Head of Department on recommendations from senior colleagues (NDPH). During the census period 63 bridging awards were made (42 women, 21 men).

Development of our REF submission

Equality and diversity has been integral to our selection of outputs for REF2021 [IES 3.4]. We invited all eligible researchers to nominate one or more outputs for consideration making it clear that they should include all to which they had contributed significantly, regardless of other co-authors. Every output was internally reviewed by at least two people and scores were then moderated by a group of three senior academics. All scores and comments were recorded, and decisions documented, in a central and secure database.

Eligible outputs were selected based on their quality score and attributed to individual authors, initially using an anonymised dataset to encourage allocation of each output to any individual who had made a sufficient contribution. We performed an equality impact assessment on a provisional selection of outputs, conducted centrally by the University to ensure limited access to sensitive data. This helped guide the process of final selection of outputs. We strictly respected the commitment of our Code of Practice that this data was not made available for any other purpose.

Development of research staff:

We are committed to the **Concordat to Support Career Development for Researchers**. Committees, including staff representatives, coordinate training activities, collect metrics on performance, ensure that all staff are provided with information about training opportunities, and review success with obtaining external fellowships to identify additional individual support that could be provided. Training leads provide an independent contact for trainees with concerns and plan training events (careers days, research presentations). Nurturing early and mid-career researchers has led to **success in competitive external fellowships** with a range of funders (e.g. Box 5).

- *Early and mid-career researchers*: We regard the development of researchers as a high priority. We have **groups supporting early- and mid-career researchers**, including post-doctoral researchers, and both organise regular meetings. We encourage attendance and presentation at conferences for early and mid-career staff.
- *Developing as supervisors*: We provide opportunities for early- and mid-career researchers with relevant expertise to join *supervision teams* for DPhil students, as expert advisors.
- *Support for fellowship and grant applications*: We organise regular clinics run by statisticians and qualitative researchers; run workshops on writing grant applications; and draw on the MSD Researchers' Toolkit, summarising University resources and support services. NDPH provides supplementary funding for the NIHR Research Design Service (RDS), which provides support for fellowship and grants applicants, regardless of funder. This includes peer review for grant and fellowship applications, mock interviews and feedback interpretation.
- *Departmental funding for fellowships:* We provide access to funding for posts and training: for example, NDPH established an **internal Fellowship scheme** during the census period, and has awarded 9 Early Career Fellowships, 3 intermediate fellowships, 1 clinical fellowship, and 4 senior fellowships to date (annual budget £0.25M).
- In NDPCHS there is a **Staff Development Fund** for training courses. We provide preferential attendance at short courses (EBM, qualitative research, health economics). During the census period, NDPH supported epidemiologist *Holmes* to undertake training for membership of the Faculty of Pharmaceutical Medicine, as part of his path to consultant accreditation.
- We helped found the **NIHR School for Primary Care Research** (current Director *Hobbs*), which supports training in primary care at levels from undergraduate (internships), doctoral and post-doctoral fellowships to transitional fellowships to independence.

Box 5: from parental leave to the pandemic

Dr James Sheppard (Senior Researcher, NDPCHS) is a primary care researcher in his mid-30s. Since 2013 he has been supported to progress from an MRC Strategic Skills Post-doctoral Fellowship to a prestigious Wellcome Trust/Royal Society Sir Henry Dale Fellowship. Along the way he has been promoted from grade 7 to 9 and gained the title of University Research Lecturer. Between the two fellowships he received bridging funding through NDPCHS. He has gained over £1m in research grant funding as PI and published papers in BMJ, JAMA and Hypertension. In 2015 he became the first person in NDPCHS to take shared parental leave, and his current job plan allows him the flexibility to leave early at least two days a week so that he can spend time with his children before bed. During the pandemic he has been supported to share home schooling with his partner. James writes:

"The NDPCHS places great importance on generating high quality research by supporting staff to develop their careers in a positive working environment. I have benefited from this a lot, being given time and encouragement to develop my own research ideas and submit fellowship applications which have allowed me to move towards an independent research career. The department's commitment to family-friendly working has enabled me to navigate this tricky stage of my career without having to sacrifice time with my young family."

- *Recognition of Distinction:* All research and academic staff can apply for the title of University Research Lecturer, Associate Professor or Professor through the University's annual Recognition of Distinction exercise. Clear and consistent criteria, with feedback, help articulate expectations. Success rates in applications for titles of distinction were **well balanced between women and men**: the success rate for the title of professor was 55% (21 out of 38 applications; success rates 55% for women and 56% for men); for Associate Professor it was 68% (44/65; success rates 68% for both); and for University Research Lecturer it was 60% (25/32; success rates 63% for women, 53% for men).

Opportunities and support for clinical staff

The proximity of NDPH on the Old Road Campus to both the John Radcliffe Hospital and the Churchill Hospital facilitates flexible working for clinicians. For example, several academics working on clinical trials hold honorary consultant contracts (e.g. *Haynes, Herrington, Mafham* in Nephrology*, Landray* in Cardiology) and are able to build synergies between clinical and research activities. Most such staff are employed directly by the University, but 5 **Category C staff** (*Gathani, Mannu, Roehr, Cutter, Sheehan*) are employed by the NHS and working in UOA2 approximately 50% FTE overall. Similar honorary consultant contracts exist for NDPCHS with Oxford Health Trust.

We contribute to the development of clinical researchers by hosting Academic Clinical Fellows who undertake joint clinical and academic training. We also host Academic Foundation Doctors and medical students to promote academic careers. NDPH supports clinical research fellows to undertake a higher degree during out-of-programme training.

Facilitating succession and strengthening research capacity

We plan carefully for **recruitment of academic leaders**, and 14 new professorial posts, including two nationally appointed NIHR Professorships, were made during the census period. **50% (6/12) of external appointees for professorial posts were women**, evidencing our commitment to equality in our recruitment process. Each of these brings leadership to a particular theme.

Trish Greenhalgh leads the £6.8M research theme **Partnerships for Health, Wealth and Innovation** for the Oxford Biomedical Research Centre and is Chief Investigator on a £1.1M Wellcome Trust Society and Ethics Award on the social science of assisted living technologies. *Catherine Pope* is providing leadership in the use of **qualitative and mixed methods** for applied health research, and is a key contributor to developing methods for evidence synthesis.

We have strengthened leadership in the use of **routine NHS data and linked datasets**. Cancer epidemiologist *Eva Morris* was recruited from Leeds to lead the strategic objective within the BDI of providing expertise in all aspects of using routine healthcare data. As part of the development of the Institute of Applied Digital Health, *Julia Hippisley-Cox* and *Simon de Lusignan* joined in 2019, as did the health economist *Stavros Petrou* with a focus on **health economic questions** that can be addressed using routine data. These additions have led to the largest concentration of primary care data services in the UK (with QRESEARCH, QSurveillance, the ORCHID collaboration with Royal College of General Practitioners, and Open SAFELY). *Philip Clarke* was recruited from Melbourne as the new Director of the Health Economics Research Centre.

Since 2013 we have trained 4 nephrologists in clinical trial methods so that they now lead (*Herrington, Haynes*) or support (*Judge*) the 6,600 patient EMPA-KIDNEY trial, or provide senior clinical support (*Mafham*) for the 15,000 patient ORION-4 study in coronary heart disease. We have also provided research training for 2 clinical oncologists (*Taylor, Cutter*) and the group led by *Darby* that are studying the benefits and risks of cancer treatments *[REF3: 05BRCA]*, leading to their appointment as consultants in Oxford and continued collaboration.

New appointments *Cornelia van Duijn* and *Angela Brueggemann* lead **epidemiological work on neurodegenerative disorders and infectious disease** respectively. Following the retirements in 2018 of Sir Richard Peto and Richard Gray, *David Hunter* was recruited from Harvard to provide strategic leadership for **cancer epidemiology**. *Robert Hills*, formerly head of the Haematology

Clinical Trials Unit and statistical lead for the NCRI/MRC trials in Acute Myeloid Leukaemia at Cardiff University, and consultant clinical oncologists *David Dodwell* and *Jeremy Braybrooke* were appointed to strengthen leadership of our **breast cancer meta-analyses**. *Gillian Reeves* was promoted internally to succeed Dame Valerie Beral after her retirement as **Director of the Cancer Epidemiology Unit**. A number of other senior appointments have been made to strengthen research capability.

Research Students

There is a major commitment to postgraduate training, with a range of procedures and initiatives to ensure thriving doctoral training programmes embedded within a wider culture of academic career development. **Three main doctoral programmes** are currently available: in NDPCHS there are programmes in **Primary Health Care** and in **Evidence-Based Health Care**, while in NDPH all students now enrol for a **DPhil in Population Health** (rather than Public Health as previously). These are managed through the Medical Sciences Graduate School to ensure consistency in admissions and training opportunities.

A major objective in the census period has been to expand our doctoral training substantially. We have been very successful in this objective, with an increase from 46 completed DPhils over the 5-year REF2014 census period (9.2 graduates per year) to 146.81 over the current 7-year census period (21.0 graduates per year): this represents **a greater than 2-fold increase in doctoral training**. In July 2020 there were 96 full-time doctoral students registered (58 population health, 27 primary care, and 11 evidence-based healthcare), and 41 part-time DPhils (14 population health, 27 evidence-based healthcare), so our initiatives continue to sustain growth.

We employ a range of methods to *recruit and fund research students:*

- *Advertising widely*: DPhil programmes are advertised through the University of Oxford, the department websites and FindAPhD.
- *Scholarship funding*: We offer at least 3 **Medical Sciences Graduate School studentships annually** (normally MRC or University funding). The **Oxford BRC plus a series of programme grants** include DPhil support either directly or via joint funding, often charitable, in parallel with the research programmes. **NDPH** offers between 5 and 10 DPhil studentships a year, plus 2 studentships through the **MRC Population Health Research Unit**. 14 students won **NIHR doctoral training fellowships** during the census period.
- *Clinical studentships*: NDPH now offers 2 **clinical studentships**. With Cambridge, Southampton and Keele, NDPCHS has delivered four **Wellcome Primary Care** Clinical Doctorate Posts a year to increase the number of general practitioners with doctorates. We have hosted one **BHF** Clinical Research Training Fellowship.
- *Hardship funds:* Since 2014, NDPH has paid hardship funding to five students in the final few terms of their DPhil, while three others received hardship funding from their research group's local resources.
- *Onward study after an MSc*: our MSc in Global Health and Epidemiology (*Lewington)*, admits approximately 25 students per year from a wide range of backgrounds, and during the census period 22 students progressed from MSc to doctoral study in NDPH. From 2020, NDPH will offer a distance-learning MSc in Clinical Trials (*Armitage*, *Bowman*) for up to 25 students. The Centre for Evidence-Based Medicine (*Heneghan*, *Mahtani*) teaches three MScs (Evidence-based Health Care, EBHC Systematic Reviews, EBHC Medical Statistics) and other taught postgraduate courses.

Doctoral training: We have established procedures to ensure effective supervision, and that students are supported during their doctoral studies in Oxford.

- An **online DPhil Supervision at Oxford course** was introduced in 2017, and from 2018 was mandatory for all supervisors, with refreshers at least every 3 years.
- All students are required to have **at least two departmental supervisors** [IES 3.3] in a co-supervision model. We have limited the number of students that any supervisor can have to ensure proper supervision, and also require that at least one supervisor has supervised

students to completion successfully. A termly report is completed by students and supervisors.
- The Directors of Graduate Studies are available to meet students one-on-one termly to oversee progress, and to help identify and correct issues before they compromise training quality.
- Departments provide significant support through **DPhil Student Support groups**, providing workshops/seminars (e.g. CV writing, grant writing), disseminating information, organising social activities, supporting the use of WebLearn and providing weekly DPhil student seminars during term-time.
- **Specific training for doctoral study** starts at induction with lectures on good academic practice (plagiarism, academic integrity and research ethics). Students attend the skills training courses provided by the Graduate School, and have access to training allowances to fund attendance on external or internal courses.
- The Student Barometer, an annual survey of student experience run by an external specialist, gives very positive feedback: **satisfaction with the 16 aspects of teaching provision surveyed ranged between 80-100%.**
- Other forms of student feedback include termly meetings of the student representatives with the Directors of Graduate Studies, their deputies and the post-graduate administration team. Student representatives sit on the departmental Graduate Studies Committees, and on MSD's Graduate Joint Consultative Committee.

Career and skills development: We support doctoral students to prepare for their future careers. DPhil students are encouraged to attend the regular events organised by the departmental Early Career groups, and events and training organised by the Careers Service. A Departmental Careers Day is run annually, which covers academic and non-academic careers. A small number of DPhil students have undertaken placements for 1-3 months outside the University e.g. at WHO.

3. INCOME, INFRASTRUCTURE AND FACILITIES

Income

Strategies for generating research income: The strategic funding priority in UOA2 departments is to match its long-term research goals with secure and sustainable long-term grant income. As compared to the 5-year REF2014 census period, average research income over the REF2021 period in UOA2 departments has **increased by 46% (from £37.8M to £55.3M), an additional £17.5M per annum**). A spike in 2015/16 is due in part to the required change in accounting practice for capital expenditure.

About one third of the growth in annual income has resulted from increased support from UK health research, where new awards from the NIHR helped more than double our annual NIHR income from £6.5M (2013/14) to £14.2M (2019/20) and annual income from the MRC (which included renewal of a core 5-year £16.8M grant for the MRC Population Health Research Unit) increased by 29% over the same period from £4.8M to £6.2M.

Income from industry was steady around £15.9M/year (2013-2018) then increased to £26.1M (2018/19) and £41.1M (2019/20) as the large EMPA-KIDNEY trial with Boehringer-Ingelheim got underway (EU Industry). Income in kind for the census period from public sources [REF4c] was £12.8M, at an average of £1.8M per annum, from NIHR centres and collaborations.

The developments in our large prospective studies have leveraged funding from partner organisations: in **China Kadoorie Biobank** (n=500,000) mean annual funding growth was £2.4M per annum; the **Million Women Study** (n=1.3M) successfully renewed core funding of £7M from CRUK in 2020, and **Mexico City Prospective Study** (n=160,000) attracted support in kind from (value £11M) and funding from AstraZeneca ($5M) to allow genotyping and exome sequencing in all participants.

In response to the rapidly emerging COVID-19 crisis, we used unrestricted philanthropic donations received for COVID-19 research to establish a new fund to support high quality, high impact

projects. Over 4 rounds over April – June 2020, 91 awards have been made to projects across the University totalling £8.2M, of which 11 awards totalling £746k were led by UOA2 researchers.

Infrastructure and facilities

Our buildings and campuses in Oxford have been developed immediately adjacent to, or physically embedded within, our partner NHS hospital sites (Figure 3), a strategy that has taken advantage of available space to pursue parallel expansions across all 4 University hospital sites that all lie within a one mile radius in Headington, Oxford. The Richard Doll Building and Li Ka Shing Centre buildings, for example, are in close proximity to the Wellcome Centre for Human Genetics, the CRUK Cancer Centre, and the Institute of Biomedical Engineering, which encourages cross-disciplinary interactions between groups. These sites also host departments in UOA1 and UOA4, and are only 2 miles from our biological sciences departments (UOA5) in the Science Area in central Oxford. Together, our buildings and sites constitute a vibrant, integrated and multi-disciplinary health sciences campus.

It is particularly valuable that NDPH's location on the Old Road Campus (ORC) places it in close proximity both to renal, metabolic and cancer medicine at the Churchill Hospital, and clinical care for cardiology, stroke and vascular surgery at the John Radcliffe Hospital. Similarly, NDPCHS staff are close to the Jericho Health Centre in the Radcliffe Observatory Quarter (ROQ). This physical integration ensures that our researchers are in touch with contemporary clinical medicine and are, literally, well-placed to run their research programmes whilst being on-hand for on-call rotas and to advise as required. This proximity has been particularly critical for attracting and retaining senior leaders (e.g. *Armitage* (clinical background in lipids and diabetes), *Bowman* (diabetes), *Landray* (cardiology), *Baigent* (*lipids and renal)* and Collins (*lipids and cardiology*) and providing training in clinical trial methodology. Thus proximity and opportunity encourages innovations for the NHS, which drive adoption and impact of new knowledge generated by UOA2.

We are planning a new £200M Information Sciences building shared with Computer Sciences and Digital Engineering on the ROQ site to house 200 staff in a new Institute of Digital Health. In addition, it is planned to build a new £30M Institute for Global Health on the ORC to provide research and teaching space of 4,500m^2, of which approximately half will accommodate UOA2 researchers.

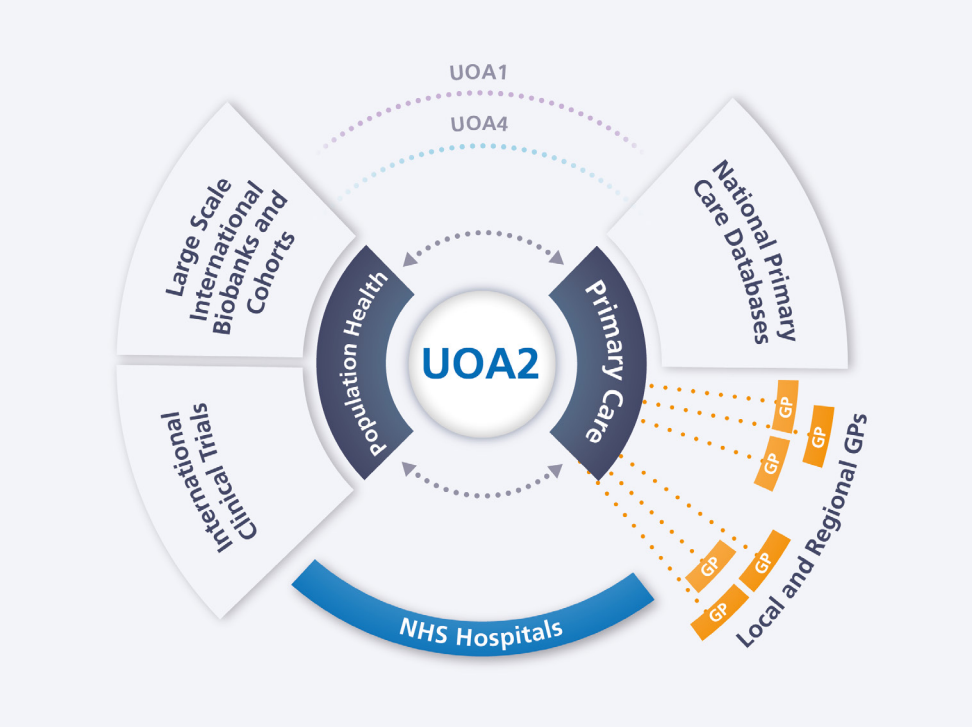


Figure 3: relationship of NDPH and NDPCHS to the wider University and NHS capabilities within and beyond Oxford.

Investment in buildings: During the census period we have been able to expand into purpose-built accommodation, which has enhanced research productivity by promoting teamwork, improving access to facilities, and facilitating expansion of research. In 2016, NDPCHS moved into a purpose-built building (the **£14M Radcliffe Primary Care Building** in the Radcliffe Observatory Quarter). A total of £1.6M has also been spent on improvements to the common areas of the Richard Doll Building, and to enable the installation of a Nuclear Magnetic Resonance machine. The **£46M, 4,700m^2 Li Ka Shing Centre for Health Information and Discovery** was completed in May 2017, housing the **BDI**, as a joint venture with the Nuffield Department of Clinical Medicine, as well as around half of NDPH's other staff.

Computing: Our computing facilities have evolved to include world-leading systems that acquire, store, analyse and distribute data for a variety of large-scale studies, holding detailed and confidential medical records on over 3M people. Currently this requires around 50 server-scale systems on-site, with additional nodes deployed within the main University system, at the Oxford Supercomputing Centre, and in China. These systems are designed and managed by in-house IT teams comprising over 50 specialist programming and systems personnel, working closely with medical and statistical staff to produce bespoke systems of any required complexity.

In addition to in-house use, our computing staff provide an **open-access data exposition and analysis service** to researchers world-wide as part of the UK Biobank and China Kadoorie Biobank, supplying data to over 15,000 researchers. This architecture is being extended to provide similar sharing global facilities to major projects such as the Million Women Study. A new UK Biobank data analysis platform, to which we have made key contributions to the design, is being put in place to manage access to whole genome sequence data on all 500,000 participants. It is intended that that system will be cloned so that other similar resources (such as CKB) can take advantage of the development of such a platform. Historically NDPH has provided recruitment and data acquisition facilities for a variety of third parties, and the software and infrastructure for this facility is currently being updated and upscaled to provide a more automated system capable of handling hundreds of thousands of patient contacts each day in a cost-effective fashion for many hundreds of external projects.

The core databases hold the **world's largest combined repository of multi-modal imaging** (MRI, OCT, DXA, ultrasound), biometric (ECG, accelerometry) and genomic data, linked to NHS records and existing/accruing epidemiological data from UK Biobank. Our current storage of around 8PB incorporates triple redundancy to safeguard this valuable and irreplaceable resource. It will shortly be hosting a world-leading collection of 500,000 exome and whole genome sequences, to be followed subsequently by the results of new 'omics-based investigations across a range of large studies of which we are a part. We are a key partner in the BMRC supercomputer facility based within the BDI. This system comprises over 7,000 compute cores, 60 GPU nodes and 18PB of working storage run by a specialist team.

The Health Experiences Research Group collect and analyse patients' experiences using rigorous qualitative research methods and founded the healthtalk.org website and archive, the **world's largest database of real-life patient experiences** in the UK and internationally.

Laboratories: We have 675m^2 of laboratory facilities with ISO 17025:2005 accreditation, and have a high-throughput automated liquid handling facility to allow rapid sample handling and array plate work for sample testing. We have large-scale offsite sample storage capacity within two offsite liquid nitrogen storage units, providing 426m^2 and 675m^2 of space respectively, with storage of over 2M aliquots from large-scale epidemiological studies and randomised trials. NDPH was responsible, with UK Biobank, for establishing Biorepository South, with a £25M Department of Health grant to the University, which houses laboratory and storage facilities for projects conducted by the NIHR-funded Biomedical Research Centres. We provided laboratory expertise and leadership, and this initiative will greatly enhance the UK's ability to archive and analyse samples from large studies cost-effectively

Research networks: We are major partners in one of the two **NIHR Biomedical Research Centre (BRC) at the University of Oxford,** with the Oxford University Hospital NHS Foundation Trust (OUH), which aims to translate basic science work into the clinical setting. The Oxford BRC was renewed competitively in 2017 (£114m over 5 years), with four BRC Themes led by UOA2 researchers, namely Clinical Informatics & Big Data; Multimorbidity & Long-Term Conditions; Obesity, Diet & Lifestyle; and Partnerships for Health, Wealth & Innovation.

We lead the **NIHR Oxford and Thames Valley Applied Research Collaboration (ARC)**, a strategic partnership between NDPCHS, the University Department of Psychiatry, hosted by the Oxford Health NHS Foundation Trust and colleagues at the University of Reading, local Trusts/Independent Clinical Services; and also the **Oxford Academic Health Science Network** (hosted by OUH), specifically in the areas of self-management, obesity, cardiovascular risk, and systems redesign.

Our Strategic Aim 1 is to develop research infrastructure to ensure that we are at the forefront of advances in **bioinformatics** and the use of technology to extract maximum value from the nationally important open-access epidemiological assets managed within UOA2. Several pivotal developments will provide national leadership in the analysis of large population cohorts. The BDI is a substantive node in the **Health Data Research-UK (HDR-UK)**, leading on innovative work on '21st Century Clinical Trials' and 'Enhancing Prospective Cohort Studies'.

Research governance and legal services: The University's Research Services provision [IES 4.1] includes a team dedicated to supporting medical sciences research and facilitates grants, contracts, ethical approvals, and knowledge exchange. They perform a particularly vital service for the conduct of our large-scale randomised trials, which operate with the University as sponsor and require a complex hierarchy of contracts with pharmaceutical companies, regional coordinating centres and hospitals in multiple jurisdictions worldwide. During the REF period, Research Services have managed 1,133 applications, 830 research awards, 603 collaboration agreements, over 3,000 clinical trial site agreements and over 1,000 other agreements led by UOA2 departments.

MSD's Business Partnerships Office supports the diversification of research income by securing funded, research partnerships with large and small businesses and securing access to 'in-kind' research resources, proprietary technologies and tools. The office also delivers a range of academic-industry knowledge exchange, innovation training and business networking opportunities and facilitates the presence of visiting industry fellows.

Libraries: We are supported by the Radcliffe Science Library, part of the Bodleian Library [IES 4.2] with over 1M volumes of printed materials, over 120,000 books and 1,400 print journals available. The Radcliffe Science Library provides complete electronic access to conference proceedings and journals from all professional societies and all major publishers and provides practical advice and training, including at the two NHS hospital sites.

4. COLLABORATION AND CONTRIBUTION TO THE RESEARCH BASE, ECONOMY AND SOCIETY

Collaborations and partnerships

We both contribute to and benefit from a wide variety of collaborations. There are many in which the University of Oxford is leading, and many others where we work in partnership, or contribute specialist expertise. We have built longstanding and strong relationships with key organisations responsible for healthcare and so are able to set up collaborative research projects rapidly to address research needs. Examples include the RECOVERY trial (collaboration between departments in different UOAs within Oxford – see below and Box 1), the ORION-4 collaboration with the Medicines Company (now Novartis) for a trial of inclisiran; innovative collaboration with NHS Digital to assess the effects of the pandemic on admissions for acute coronary syndromes and care of colorectal cancer, and the OpenSAFELY analytics platform, which was built in the early part of the pandemic (collaborations with another University, electronic record suppliers, and the NHS; **Box 2**).

Collaborations within the Oxford area include:

- Collaborations within the University, such as those with (i) the **Nuffield Department of Medicine** to develop the **RECOVERY trial**, which was designed and initiated rapidly in the early weeks of the COVID-19 pandemic (**Box 1**); (ii) the **Department of Cardiovascular Medicine** in the BHF-funded Centre of Research Excellence Research Theme of Big Data, and is also the BRC and NIHR-funded AMALFI trial to assess the value of a wearable patch for detecting atrial fibrillation; (iii) the **Wellcome Trust Centre for Human Genetics** on the BDI and the China Kadoorie Biobank; (iv) the **Department of Psychiatry** on perinatal mental health (PRU-MNHC); (v) the **Nuffield Department of Surgery** on the 3C trial involving 18 of the UK's 23 transplant units, and on joint prostate cancer projects in EPIC, including studies of emerging potential biomarkers of risk; and (vi) with **Biomedical Engineering** on evaluating 'telehealth' systems in COPD and hypertension and Psychiatry on the treatment of mental health problems in diabetes (within the NIHR School for Primary Care Research). We also coordinate projects with a range of partners across the University. These include, for example, the **£6M Wellcome Trust-funded LEAP (Livestock, Environment and People) programme**, which includes partners not only from MSD, but also from the Mathematical, Physical and Life Sciences Division and Social Sciences Division.
- The **Wellcome Centre for Ethics and Humanities** leads collaborative research into the ethical aspects of advances in neuroscience, Big Data, genomics, and global connectedness. It is a collaborative initiative between the **Ethox Centre**, the **Oxford Neuroscience, Ethics and Society Group**, the **Oxford Uehiro Centre for Practical Ethics** and the **Oxford Centre for the History of Science, Medicine and Technology**, embracing medicine (UOAs 1 and 2), philosophy (UOA 30) and history (UOA 28).
- Local collaborations in the primary care setting include via the **Academic Health Science Network** (AHSN) whose Chief Executive is co-investigator on several of our grants and collaborates in the **NIHR Oxford and Thames Valley Applied Research Collaboration**. In particular this facilitates links with the Buckinghamshire, Oxfordshire and Berkshire West Integrated Care System, which covers Thames Valley (1.8m people) with three CCGs, six NHS Trusts and 175 GP surgeries. Our research programme links to the local sustainability and transformation plan including: Self-management (an important part of several of our research themes, including Cardiovascular/Metabolic, Health Behaviours, Infection, Digital Health); new ways of working in primary care (Digital Health, EBM); and methods for enhancing the understanding of the implementation of digital innovations (Cardiovascular/Metabolic, Health Behaviours, Infection, Digital Health).
- We played a major part in the re-designation in 2020 of Oxford's Academic Health Science Centre as the **Oxford Academic Health Partners (OAHP)**. OAHP brings together the University with 2 NHS Hospital Trusts (OUH and OH), Oxford Brookes University and the Oxford AHSN, enabling joint working in research infrastructure, training, streamlined management and governance, and clinical research facilities. The **NIHR Thames Valley and South Midlands Local Clinical Research Network (LCRN)**, hosted by OUH, supports clinical research across the region and UOA2 staff lead the LCRN Primary Care theme.

External collaborations led by Oxford:

Many of our collaborations are international, some led by Oxford and many drawing on collaboration from colleagues in multiple countries. 52% of papers published by our REF1 staff have international co-author(s). Examples include:

- We coordinate very large international randomised trials using our established international network of collaborators. For example, the **ORION-4 trial** of 15,000 people with coronary heart disease involves collaboration with the TIMI group (Boston, USA), who are recruiting 3,000 patients from 77 hospitals in the US. Similarly, the **EMPA-KIDNEY trial** in 6,000 people with chronic kidney disease is recruiting in 8 countries and 227 hospitals.
- Our meta-analyses of individual patient data in vascular disease (eg the **Cholesterol Treatment Trialists' Collaboration)** and in breast cancer (the **Early Breast Cancer Trialists' Collaborative Group**) involve investigators representing almost 700 trials worldwide, in aggregate involving over 1.1M patients worldwide. We also coordinate

influential collaborative meta-analyses of individual data from observational studies of intrinsic and extrinsic hormonal factors and women's cancers, which have led, for example, to new advice on the use of HRT.
- **DIPex International involves collaboration with 14 countries**, all of which conduct research using methods developed in Oxford to research patient experience.

Collaborations with investigators in a single non-UK country have led to important projects particularly in lower and middle income countries, including:
- **China Kadoorie Biobank** and **other prospective studies (~4.2M participants in total)** involve large collaborations in China, Latin America (Mexico and Cuba), India, and Russia. The China Kadoorie Biobank and Mexico City Prospective Study are the only two large-scale prospective cohorts with blood samples in these ethnic groups.
- **NCI Breast and Prostate Cancer Cohort Consortium,** which works with principal investigators from six large US cohort studies for studies of breast and prostate cancer genetics and gene-environment interactions.

Other collaborations address questions of particular relevance to the UK (e.g. care in the NHS), and generally involve investigators in the UK alone, either across the country or locally as appropriate: Examples led by Oxford include:
- The **Policy Research Unit in Maternal and Neonatal Health and Care**, a multidisciplinary collaboration across 8 universities and NHS institutions including different clinical specialties (midwifery, obstetrics, psychiatry, neonatology, public health) and methodological expertise (epidemiology, statistics, health economics, social science).
- The **AgeX trial,** led by our Cancer Epidemiology Unit, is a national collaboration with the NHS Screening Service which is assessing the effects of offering an extra screen to women aged 47-49 and/or to women after age 70. The trial is the largest ever individually randomised trial (over 4M women).
- Our **Primary Care and Vaccines Collaborative Clinical Trials Unit** supports investigator-led multi-centre collaborative studies and currently has active collaborations with the Universities of Birmingham, Cardiff, Dundee, Edinburgh, Leeds, Liverpool, Keele, Nottingham and Southampton.
- The Primary Care Epidemiology Group leads the NIHR national collaboration on **risk prediction modelling for COVID** commissioned by the CMO via the New and Emerging Respiratory Virus Threats Advisory Group (NERVTAG). This includes researchers from Edinburgh, Belfast, LSHTM, UCL, Leicester, Cambridge, Imperial, NHS England, NHS Digital, Office of National Statistics
- The **NIHR School for Primary Care Research** in partnership with the **7 other leading UK primary care departments**, investing £5M annually, has led to major studies including large trials, observational studies and social science research.

We also collaborate widely in NIHR or charity-funded UK-wide collaborations across centres including: hypertension following stroke/TIA (Cambridge, Edinburgh, Southampton); hypertension in pregnancy (Birmingham, Kings); atrial fibrillation (Cambridge, Warwick, Bristol, Sweden); adherence to medication (Cambridge); and digital health for diabetes (Manchester, Exeter, Bangor, Leicester, West Midlands).
We collaborate with **Public Health England** to provide UK community surveillance of infectious diseases and vaccine effectiveness; and members of Health Protection Research Units and vaccine uptake analyses via QSurveillance

Collaborations with industry: We collaborate with industrial partners when such collaboration is of mutual interest to address important scientific questions (that is, we do not function as a contract research organisation). 7.3% of papers from our REF1 staff in the REF period have one or more industrial co-authors. There has been a substantial increase in our industrial research income (Section 3), chiefly because we have now developed the **critical mass and infrastructure** to design and run more than one large international randomized phase 3 trial to a regulatory standard simultaneously. For example, we are currently working with **Boehringer Ingelheim** to conduct the EMPA-KIDNEY trial (6,000 patients with chronic kidney disease in 8 countries) and concurrently

with the **Medicines Company** (now **Novartis**) to run the ORION-4 trial (15,000 patients with coronary heart disease in 2 countries), with total award value >£150M. By working with the Medicines Company to streamline the design of ORION-4 and hence reduce costs, we then engaged with Novartis and the NHS to provide evidence to bring inclisiran forward into late-stage trials leading to business decisions and the rapid uptake of positive results.

Other examples of industry collaboration include:

- Partnerships with **Regeneron** and **AstraZeneca** in the Mexico City Prospective Study have yielded £11M of in-kind funding to allow genotyping and exome sequencing in all 150K participants, and a $5M grant to support the project in Oxford and Mexico.
- Strong collaborations with **all accredited GP software suppliers**: our researchers have worked with EMIS and other clinical system suppliers to implement a range of novel risk algorithms (QRISK, QStroke, QFracture, QDiabetes, QBleed, QMortality, QAdmissions, QCancer) into daily practice within the NHS and occupational health settings. We are planning a new Institute for Applied Digital Health in order to build further capacity.
- We collaborate with **3 leading supermarkets** to obtain access to store-level sales data and loyalty card transactions to evaluate interventions for healthier food purchasing.

Collaboration with NHS Digital: As part of our strategy to make Oxford a world-leading centre for the use of Big Data and digital innovation, we have developed collaborations with NHS Digital. Following our experience of working with NHS Digital in large-scale trials in cardiometabolic disease (e.g. the 25,000 patient THRIVE trial which led to niacin being removed from the European market for cardiovascular protection), we collaborated with them on the **ORION-4 trial of inclisiran**, which aims to recruit 12,000 patients with coronary disease in the UK. NHS Digital provided the numbers of potentially eligible patients at every UK hospital, enabling trial sites to be selected to maximise trial efficiency; once a site agrees to participate and the necessary privacy approvals are in place, NHS Digital provides disease history and contact details so patients can be invited to study clinics centrally. This collaboration proved important at the beginning of the COVID-19 pandemic: our collaborative relationship with NHS Digital enabled **rapid set up of the RECOVERY trial** (Box 2).

The versatility of our collaboration with NHS Digital is illustrated by the implementation of a **new platform to enable national risk stratification of patients at high risk of poor outcomes from COVID** following a commission by the CMO. Although developed because of the pandemic, the resulting infrastructure will enable risk stratification for a wide range of other conditions.

Contributions to the discipline during the census period

The following summarises recognition and contributions that occurred during the REF period.

National honours:

- *Ben Goldacre*, whose contributions include founding the AllTrials campaign *[REF3: 06TRIALS]*, and chairing the NHS HealthTech Advisory Board, was awarded the MBE in 2018 for services to evidence in policy;
- *Jane Armitage*, who has led some of the world's largest and most influential randomized trials of statin therapy *[REF3: 09STATINS]* as well as other drugs, was awarded the OBE in 2019 for services to medical research;
- *Richard Hobbs*, who leads NDPCHS and has made major contributions in cardiovascular epidemiology and clinical trials, was awarded the CBE for services to medical research in 2019.

Election to learned societies

A total of 6 staff, the majority of whom were women were elected to learned societies:

- *Sarah Darby*, who has made major contributions to research into the risks of cigarette smoking and radon, as well in the treatment of breast cancer *[REF3: 05BRCA]*, was elected Fellow of the Royal Society, and of the Academy of Medical Sciences, in 2019.

- *Trish Greenhalgh (2014), Susan Jebb (2018), Cornelia van Duijn (2020), Colin Baigent (2019) and Chris Butler (2016)* were elected Fellows of the Academy of Medical Sciences for their outstanding contributions to medical research.

Elections to fellowship of professional societies included:
Royal Colleges: *Paul Aveyard* RCGP, RCP; *Rory Collins* RCP Honorary Fellowship*; Jenny Kurinczuk* Fellow Honoris Causa, RCOG; *Marian Knight* Fellowship Ad Eundem, RCOG
Other societies: *Rory Collins* British Pharmacological Society, Honorary Fellowship; *Catherine Pope* Fellow of the Academy of Social Sciences.

Honorary degrees: *Rory Collins***,** honorary doctorate, McMaster University; and honorary Doctor of Science, Warwick University; *Trish Greenhalgh*, Honorary Doctorate, University of Oslo; and *Sara Ryan,* Honorary Doctor of Science, Oxford Brookes University.

Prizes: Among the many prizes won there have been notable awards for **outstanding publications**: several have been awarded paper of the year by the BMJ (*Paul Aveyard* 2014, *Julia Hippisley-Cox* 2019, *Marian Knight* 2020), and by the RCGP (*Julia Hippisley-Cox* 2018*, Chris Butler* 2019*)* and *Trish Greenhalgh* was given the BMJ Editor's Award for 'Persistence and Courage in Speaking Truth to Power' in 2016.

Prizes for research excellence included international prizes for *Rory Collins*, including the International Okamoto Award, Japan Vascular Disease Research Foundation; the RCP Ambuj Nath Bose Medal; the British Cardiovascular Society Mackenzie Medal; and the European Society of Cardiology Gold Medal; *Richard Hobbs* won the 2018 RCGP Discovery Prize, awarded every three years for outstanding research in general practice; *Susan Jebb* was awarded the British Nutrition Foundation Prize and the John Maddox Prize; and *Catherine Pope* was awarded the SAGE Prize for Innovation and Excellence. **NIHR Senior Investigator awards** were conferred to 14 of our senior staff**:** *Doug Altman (deceased), Paul Aveyard, Chris Butler, Andrew Farmer, Trish Greenhalgh (Emeritus), Carl Heneghan, Richard Hobbs (Emeritus), Susan Jebb, Marian Knight, David Mant (Emeritus), Richard McManus, Stavros Petrou, Charles Vincent (Emeritus), Sue Ziebland.*

Awards for **contributions to general practice** include RCGP awards: having won the Yvonne Carter award for outstanding new researcher in 2016, *Kamal Mahtani* was elected to the John Fry award in 2020; and *Chris Butler* was voted Wales GP of the Year in 2019.

Editorial roles held range from editor-in-chief or equivalent (*Fiona Alderdice*, *Paul Aveyard*, *Angela Brueggemann*, *Chris Butler*, *Carl Heneghan*, *Simon de Lusignan, Mike Parker*, *John Powell*), to associate or assistant editorial positions (16 staff), with many fulfilling multiple roles.

Membership of national or international committees: Collectively we have made a major contribution to national and international research governance during the census period. Several staff have played **roles in key COVID-19 committees**: *Mike Parker* is a member of the Scientific Advisory Group for Emergencies (SAGE); *Anthony Harnden* is Deputy Chair of the JCVI that has been responsible for prioritisation and roll-out of vaccines against SARS-Cov2. *Julia Hippisley-Cox* played a major role in documenting the risks of COVID-19 in different population groups through her work on QCOVID, chairs the NERVTAG COVID risk stratification working group, and is a member of the SAGE data subgroup, and the national COVID risk stratification implementation group*. Chris Butler* is a member of EU COVID Trials Coordination Board and *Catherine Pope* is a member of the ESRC-COVID19 Panel and, with *Richard Hobbs*, of the College of Experts for the DHSC/UKRI COVID-19 Rapid Response rolling call; *Sue Ziebland* is a member of the DHSC/UKRI COVID rolling research committee (2020) and, with *Richard Hobbs,* the NIHR Long COVID panel.

In addition to leading major national and international research projects, as above, we also provide **strategic leadership for national research infrastructure**. Examples include: *Rory Collins* is the CEO and PI of the 500,000 person **UK Biobank**, an internationally distinctive resource for epidemiological studies; *Ray Fitzpatrick* is the National Programme Director for the **NIHR Health**

Services and Delivery Research Programme, which is producing rigorous evidence to improve the quality, accessibility and organisation of health services; *Julia Hippisley-Cox* directs **QResearch**, which is helping to provide nationally representative data from general practice; *Martin Landray* is the Oxford Hub director for **Health Data Research UK**; which includes the Hub for Clinical Trials "**NHS DigiTrials**" and the success of the RECOVERY trial for COVID-19 treatments exemplifies how trial design and execution is being transformed under his leadership; *Simon de Lusignan* is Director of the PHE national flu/COVID Community Surveillance Sentinel Network.

We make a major contribution to the **work of the NIHR**. *Sue Ziebland* directs the **NIHR Research for Patient Benefit (RfPB) Programme** and is a member of the **NIHR strategy board**. *Andrew Farmer* is **Director of the NIHR HTA programme** (2020). We have **4 Chairs of NIHR committees** (*Andrew Farmer,* Health Technology Assessment General Funding Committee; *Marian Knight*, Programme Grants for Applied Research funding panel; *Kamal Mahtani*, HTA Community Health and Social Care Committee, and the HTA Committee; *Richard McManus,* Doctoral Fellowship Panel); **2 Deputy Chairs** (Geoff *Wong,* HTA Community Health and Social Care Committee; *Sue Ziebland* Research Design Service advisory board) and **4 others are members of a total of 8 NIHR committees** (*Paul Aveyard* Policy Research Programme Board; *Gail Hayward* I4I funding committee, HTA Commissioned Calls Board, and Senior Investigators appointments panel; *Stavros Petrou* Pre-Doctoral Fellowship Assessment panel, *Pope* Research for Patient Benefit Panel, Health Services & Delivery Research Funding Committee; and Academy Selection Panel).

Several individuals contribute **expert advice to the Government** other than through NIHR. For example, *Rory Collins* is a member of the Government's Life Sciences Council Innovation, Research and Data Expert Group, Life Sciences Council Industrial Strategy Implementation Board, and the National Genomics Board, as well as NHS Digital's Research Advisory Board; *Ben Goldacre* chairs the Health Tech Advisory Board at the DHSC, and reports directly to the Secretary of State; *Julia Hippisley-Cox* is a member of the CMO's Advisory Group on the future of National Screening; *Martin Landray* is a member of the NHS Digital Research Advisory Group, and Expert Lead (Clinical Trials) for the Pandemic Preparedness Partnership Steering Committee advising the UK's G7 Presidency; and *Stavros Petrou* is a core member of the Department of Health's Policy Research Programme Commissioning Panel.

Several staff with specific expertise provide **advice to other national committees and boards**. For example, *Susan Jebb* is one of the country's leading experts on **nutrition** [ICS-02SUGAR], and is a member of 7 national committees for the DHSC, DEFRA, and NHS England. *Mike Parker* is an international authority on the **ethics of genomics**, and chairs the Ethics Advisory Committee for Genomics England, is a Non-Executive Director of Genomics England; and is co-chair of the Data Sharing & Ethics Working Group, International Common Disease Alliance). With specialist expertise in **informatics for primary care**, *Simon de Lusignan* is a member of the British Computer Society Health and Care Executive, the European Federation for Medical Informatics (EFMI) Council, the Board of the International Medical Informatics Association and EFMI Primary Care Informatics, and is Working Group Chair for the WHO Digital Health Technical Advisory Group (DHTAG) and Roster of Experts.

We contribute to the **governance and funding of research**. In the UK, these include: the Medical Research Council (*Paul Aveyard* Public Health Intervention Development Funding Board; *David Hunter* Population and Systems Medicine Board); CRUK (*Naomi Allen,* Chair of the Epidemiology Expert Research Panel; *Paul Aveyard*, chair of the Tobacco Advisory Group); the British Heart Foundation (*Colin Baigent*, vice-chair of the Clinical Studies Committee); and Arthritis Research UK (*Ray Fitzpatrick,* chair of the Health Services Research Committee until 2019). Several scientists have roles in **the governance of research in other countries**. For example, *Paul Aveyard* was chair of funding calls on smoking cessation for the French National Cancer Institute and Irish Cancer Society, and chaired the French ARC Foundation call on tertiary prevention in cancer; also in France *Julia Hippisley-Cox* was a member of the Scientific Evaluation Committee at the French National Cancer Institute; whilst in Ireland *Ly Mee Yu* was a panel member of the

Health Research Board Definitive Interventions and Feasibility Awards. We also help **improve healthcare at the supranational level**. For example, *Colin Baigent* was Co-chair of the 2019 European Society of Cardiology/European Atherosclerosis Society Guidelines on the Management of Dyslipidaemia, and now chairs the ESC Committee on Practice Guidelines; *Richard Hobbs* was inaugural Chair of the ESC Council for Primary Care and chairs the European Primary Care Cardiovascular Society.

Several of our staff have senior roles in **healthcare regulation**. Within the **General Medical Council** *Anthony Harnden* is a Council member and *Julian Hancock* is chair of the Professional & Linguistic Assessment Board. Within the **Medicines and Healthcare products Regulatory Authority (MHRA)**, *Valerie Beral* is a Board member, *Paul Aveyard* is a member of the Nicotine Containing Products Working Group and *Richard Stevens* is deputy chair of the Independent Scientific Advisory Committee for MHRA database research.

Named lectures and visiting professorships: Oxford's work has been showcased at 15 named lectures. Examples have ranged from *Zhengming Chen* delivering the 2019 Archie Cochrane Lecture at Green Templeton College, when he spoke on the topic of **Big biobanks in the East and West** and argued for the potential for such studies to transform our understanding disease aetiology; to *Rory Collins* delivering the prestigious 2017 Paul Dudley White International Lecture on **Post-Truth Medicine: Death and Disability by Disinformation** at the annual American Heart Association meeting, in which he argued that 'fake news' in medicine threatens human health, and gave the example of the adverse consequences of misinformation about statin side-effects; to *Susan Jebb,* who gave the 2018 Queens Lecture in Berlin on the topic **Diet, Obesity And Health: from science to policy**, in which she outlined how science and industry could work together to improve human nutrition. Several of our senior scientists have **visiting or honorary professorships**, reflecting the esteem in which they are held internationally (e.g. *Zhengming Chen* has 3 visiting positions in China; *Marian Knight* a visiting professorship at the University of Leiden; and *Catherine Pope* visiting positions in Tromso, Norway; and Washington DC).