

Transforming health through innovation: Integrating the NHS and academia - supporting case studies

Box 1: Examples of some of the UK's most significant contributions to advances in patient care since the inception of the NHS

The UK's NHS was launched on 5 July 1948. Since then, the UK has made many significant contributions to medical science resulting in ground-breaking advances in patient care. The case studies in the timeline below present a selection of some of the UK's most significant research contributions to the advancement of patient care since the inception of the NHS. The list is not exhaustive, and additional examples can be found in the resources listed in Reference 1.¹

1940s

Development of penicillin as a drug

The antibiotic properties of the Penicillium mould were first discovered by Sir Alexander Fleming FRS FRSE in 1928 in his laboratory in St Mary's Hospital in London. Ground-breaking work by Sir Ernst Chain FRS and Lord Florey OM FRS in the 1940s to purify and extract penicillin then enabled it to be mass produced as a life-saving drug.² Penicillin antibiotics became the first effective treatments against many bacterial infections and are still widely used today.^{3,4}

Intraocular lens for cataract patients

Cataracts form when the eye's lens becomes cloudy leading to blurry vision and eventually blindness.⁵ The first successful implantation of an intraocular lens was performed by Sir Harold Ridley FRS at St Thomas's Hospital in 1949 following the extraction of a patient's cataract.⁶ According to the World Health Organization, the number of cataract surgeries performed in 2010 is estimated to be 20 million, and this is expected to reach 32 million by 2020.⁷

1950s

Smoking linked to lung cancer

The link between smoking and lung cancer was first made by Professor Sir Richard Doll CH OBE FRS and Professor Sir Austin Bradford Hill CBE FRS in 1950.⁸ Their findings changed policy and treatment internationally. In 1954, around 80% of adults in the UK smoked, by 2017 this had fallen to 15.5%.^{9,10}

1960s

First variable rate pacemaker

Researchers at the University of Birmingham developed the first variable rate pacemaker, which patients could control according to their activity.¹¹ This advance reduced the strain on patients' hearts and increased their lifespans.¹²

Discovery of the link between transplantation and immunology

In 1960, a Nobel Prize was awarded to the National Institute of Medical Research's Sir Peter Medawar OM CBE FRS and Sir Frank Macfarlane Burnet OM KBE FRS for their discovery that the rejection of skin grafts was an immune response, which could be overcome.^{13,14} This showed that transplantation between a genetically non-identical donor and host was possible for animals, and would be for humans.¹⁵

<p>1970s</p>	<p>The discovery of DNA sequencing</p> <p>DNA sequencing is used to determine the order of nucleic acids in DNA and has greatly enhanced our ability to diagnose genetic diseases.¹⁶ Early DNA sequencing methods began to be developed in the 1970s by academic researchers, with many of the breakthroughs occurring in the UK.^{17,18}</p> <p>The first ‘test tube baby’</p> <p>In vitro fertilisation (IVF) is a technique where an egg is fertilised outside the body before being implanted in a woman’s uterus and is available to people experiencing fertility problems. UK scientists were at the forefront of the development of this procedure.¹⁹ The world’s first human born after conception by IVF was from the UK.²⁰</p> <p>The invention of magnetic resonance imaging (MRI)</p> <p>Sir Peter Mansfield FRS from the University of Nottingham devised a way to harness cells’ natural magnetic properties to produce images of soft tissues in humans, leading to the development of MRI.²¹ Today, all major UK hospitals have whole-body MRI scanners – pioneered by researchers at the University of Aberdeen in the 1980s – and the technique is used to diagnose and monitor many diseases.²² Annual rates of MRI examination are as high as 140 for every 1,000 inhabitants in the developed world.²³</p> <p>First portable defibrillator</p> <p>Researchers working at Queen’s University Belfast developed the first portable defibrillators, which enabled patients suffering from a coronary attack due to ventricular fibrillation (a serious disturbance in the heart’s rhythm leading to an inability to pump blood) to be reached faster.²⁴ Their first prototype mobile defibrillator weighed 70kg and could be installed in an ambulance. This then led to the development of the first truly light-weight portable defibrillator, weighing just over 3kg.</p>
<p>1980s</p>	<p>The invention of DNA fingerprinting</p> <p>The technique of genetic fingerprinting was first developed by Sir Alec Jeffreys CH FRS FMedSci at the University of Leicester in 1984.²⁵ This revealed the variations in DNA unique to each individual, except for identical twins. Genetic fingerprinting is now widely used in medicine, forensics and paternity testing, among many other applications.²⁶</p> <p>World’s first robotic surgery</p> <p>In the late 1980s, Imperial College London developed the first robot to be used for prostate surgery, which reduced the risk of operative and post-operative complications.^{27,28} The use of robotic assistance has since expanded into other areas of surgery.²⁹</p>
<p>1990s</p>	<p>The first cloning of a mammal</p> <p>Dolly the Sheep, the world’s first mammal to be successfully cloned from an adult cell, was born in Scotland’s Roslin Institute in 1996.³⁰ This fundamental achievement paved the way for a series of important advances in stem cell research.³¹</p> <p>Practice-changing clinical trials in radiotherapy and imaging</p> <p>The Institute of Cancer Research and The Royal Marsden have led major clinical trials in radiotherapy and imaging, which have changed standard clinical practice for cancer treatment, forming the basis of NICE and international guidelines, and helping set standard care in the UK. Patients all over the world are benefitting from these changes in clinical practice.³²</p> <p>Reducing the risk of neural tube defects and spina bifida with folic acid</p> <p>A nine-year-long Medical Research Council (MRC) clinical trial showed that giving folic acid to pregnant women at high risk of having a pregnancy with a neural tube defect reduces the risk of major brain and spine birth defects.³³ Flour fortification with folic acid is now mandatory in over 70 countries.³⁴</p>
<p>2000s</p>	<p>Anti-tumour necrosis factor alpha (anti-TNFα) therapy</p> <p>UK researchers played a crucial role in the development of monoclonal antibodies and therapies against inflammatory diseases, such as rheumatoid arthritis (RA).³⁵ One such therapy, anti-TNFα therapy, is used to stop inflammation primarily in RA, but is also successfully used in other inflammatory conditions.^{36,37} There are currently several NICE approved anti-TNFα treatments, which have transformed the treatment of inflammation for thousands of people in the UK and across the world.³⁸</p> <p>Brain cooling treatment for newborns starved of oxygen</p> <p>Imperial College London researchers pioneered the implementation of a brain cooling treatment to improve the survival of newborns starved of oxygen during birth.^{39,40,41} It is now recommended by NICE guidelines and is the standard of care in most resource-rich and -intermediate countries.^{42,43}</p>

<p>2000s</p>	<p>Benefit of anticoagulation in older people with irregular heartbeats</p> <p>The Birmingham Atrial Fibrillation Treatment of the Aged (BAFTA) study, led by researchers at the University of Birmingham and including almost 300 UK general practices, demonstrated the benefit of warfarin (a blood thinning medicine) in patients over 75 with atrial fibrillation (where the heart beats irregularly).⁴⁴ Those prescribed warfarin had half as many strokes, bleeds or blood clots as those prescribed aspirin. The study resulted in the implementation of a nationwide mechanism for practice-based anticoagulation.^{45,46}</p>
<p>2010s</p>	<p>Meningitis B (MenB) vaccination</p> <p>Researchers at the University of Oxford were instrumental in the development of a vaccine against MenB, which accounts for about 90% of meningococcal infections in the UK, equating to between 500 – 1,700 cases each year.^{47,48,49} All new-born babies in the UK are now routinely offered the MenB vaccination, which has been highly effective and potentially life-saving.⁵⁰ The introduction of the MenB vaccination programme has seen cases in infants aged less than one drop by 42%.⁵¹</p> <p>Nurse staffing numbers in hospitals</p> <p>Researchers in the UK contributed to the Registered Nurse Forecasting (RN4CAST) consortium, which studied how organisational features of hospital care impact on nurse recruitment and retention, and patient outcomes.^{52,53,54} This work directly influenced national policy decisions and underpinned ‘safe nurse staffing’ guidelines and legislation in Wales, Ireland, Scotland, Germany, and beyond Europe, in Australia and Chile.⁵⁵</p> <p>Dressings for epidermolysis bullosa</p> <p>Adults with epidermolysis bullosa, a group of rare inherited skin disorders that cause the skin to become very fragile, have extensive chronic wounds that seriously compromise their quality of life.⁵⁶ Research at King’s College London has led to the development and commercialisation of an innovative range of dressing garments, Skinnies WEB™, which radically improve patient experiences and outcomes, and significantly reduce treatment costs.⁵⁷ Using the garments instead of the standard of care bandages resulted in an average annual saving to the NHS of £10,943, approximately 13% of total wound care costs.⁵⁸</p> <p>Feedback to prescribers about prescribing errors</p> <p>Research at Imperial College Healthcare NHS Trust into the nature and causes of prescribing errors in hospital inpatients identified the lack of feedback on individual prescribers’ errors as a key issue. The group explored the acceptability of different approaches to receiving feedback, which led to the implementation of a new approach within the organisation, as well as in other NHS Trusts around the UK, following the production of a toolkit.^{59,60,61}</p> <p>Transforming treatment for oestrogen-receptor positive breast cancer</p> <p>The Institute of Cancer Research and The Royal Marsden NHS Foundation Trust played a leading role in the clinical development of a class of hormonal drugs called aromatase inhibitors that are effective in treating oestrogen receptor-positive breast cancers.⁶² Overall, this work has changed the way doctors treat this type of breast cancer across the world, saving the lives of thousands of women every year, and sparing many from unnecessary chemotherapy.⁶³</p> <p>Primary biliary cirrhosis (PBC) drug development</p> <p>PBC is an autoimmune chronic disease of the liver leading to impairment of bile flow which can lead to build-up in the liver and cause damage.⁶⁴ It is thought to affect up to 20,000 people in the UK, some of which suffer from a more aggressive form of liver disease that can lead to liver failure and the need for a liver transplant.^{65,66} Scientists from UK-PBC – a collaboration between patients, clinicians, researchers and industry – provided crucial evidence to support the approval of the first new drug for this condition in 20 years, obeticholic acid.^{67,68} Its use has been approved by NICE and offers the 30% of patients who are unresponsive to other available therapies an additional treatment option before considering a liver transplant.⁶⁹</p> <p>Gene therapy for haemophilia</p> <p>Haemophilia is a rare, mostly hereditary condition affecting the blood’s ability to clot. The current gold standard treatment of severe disease is regular infusion of clotting factor concentrates.^{70,71} Researchers at the UCL Cancer Institute developed the first gene therapy to treat haemophilia A, which has recently been successfully trialled in humans. Benefits were still apparent over one year following a single treatment with the gene therapy drug.^{72,73} Gene therapy remains a potentially revolutionary future prospect for patients, replacing the need for regular injections with a single-dose treatment.^{74,75}</p>

2010s

Antisense therapy for Huntington's disease

Advances have been made in the development of gene silencing antisense oligonucleotide (ASO) therapies to target the genetic cause of Huntington's disease.^{76,77} The therapy was safe and well tolerated in its first human trial at the National Hospital for Neurology and Neurosurgery at University College London Hospital (UCLH), and successfully lowered the level of the harmful huntingtin protein in the nervous system. This presents an exciting prospect for patients, as there are currently no disease modifying treatments for Huntington's disease.⁷⁸

Chimeric antigen receptor (CAR) T-cell therapy

CAR T-cell therapy is an innovative new treatment type that involves reprogramming a patient's own T-cells to target their cancer.^{79,80} The NHS now provides CAR T-cell therapies for children and young people with B-cell acute lymphoblastic leukaemia, marking a new era of personalised cancer treatments.^{81,82} Children at Great Ormond Street Hospital and adults at UCLH have been the first in Europe to receive this ground-breaking treatment.⁸³

First gene therapy trials for children without an immune system

Pioneering work undertaken by scientists at the UCL Institute of Child Health has led to the development of the first gene therapy for children born with Severe Combined Immunodeficiency (SCID), a previously lethal condition in which children are born without a functioning immune system.^{84,85} Over 50 SCID patients have now been treated successfully, freeing them from undergoing weekly injections.⁸⁶

Stem cells for macular degeneration in the retina

Age-related macular degeneration (AMD) is a major cause of blindness in older people, where the part of the retina called the macula is damaged.^{87,88} A small but ground-breaking clinical study, pioneered by the London Project to Cure Blindness hosted at Moorfields Eye Hospital using a new treatment derived from stem cells, has resulted in patients with 'wet' AMD regaining reading vision.^{89,90,91} Doctors hope that this treatment will also be successful in the more common 'dry' AMD and result in an affordable 'off-the-shelf' therapy that could be made available to NHS patients.⁹²

Box 2: Involving patients in research

Throughout the course of this project, we heard that patients would value being offered opportunities to engage in research more systematically at the point of care and more equitably across the UK.⁹³ Involving patients in research improves the quality of research studies, and their relevance for patients and the health service.⁹⁴ Early involvement with patients in the design and implementation of studies is therefore important and should be sustained throughout the R&D process, including informing patients of the outcomes of research.⁹⁵ To enhance patient participation in research, it is not only important that researchers understand the value of engaging with patients and the public and are trained to do so effectively, but also that patients and the public understand the benefit of research and the importance of the role they play.

Box 3: The decline in number of clinical academics and of clinical academic reader and senior lecturer posts

Data from the Medical Schools Council staffing survey from 2004-2017 shows that, while the total number of NHS medical consultants and general practitioners (GPs) has increased (Figure 1A), the number of clinical academic medical consultants has decreased from 2,436 in 2004 to 2,290 in 2017 and the number of clinical academic GPs has remained low, rising slightly from 127 in 2004 to 176 in 2017 (Figure 1B). This equates to a 3.3 percentage point decline in the proportion of clinical academic NHS medical consultants, from 7.5% of medical consultants in 2004 to 4.2% in 2017 (Figure 2). A significantly smaller proportion of GPs are clinical academics, stagnating at around 0.4% of the GP workforce over this period. The proportion of clinical academic medical and GP roles in universities has declined from 3.7% of the medical and GP consultant workforce in 2004 to 2.6% in 2017 (Figure 3A). Over this period, while the number of professor roles has increased from 1,145 to 1,406 posts, the number of reader and senior lecturer roles has declined from 1,418 to 1,059 (Figure 3B). Overall, there has been a slight decline in the number of clinical academic medical and GP roles in universities, despite the increase in the total number of NHS medical consultants and GPs.

Figure 1A: Number of NHS medical consultants and GPs over time

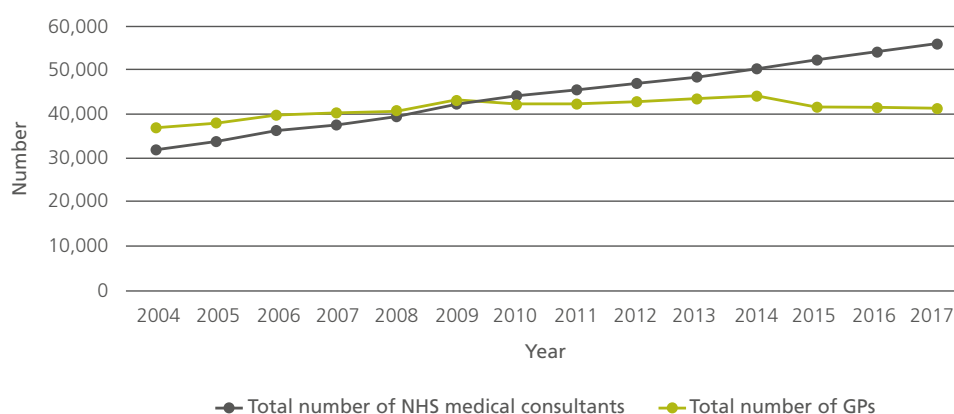


Figure 1B: Number of clinical academic NHS consultants and clinical academic GPs over time

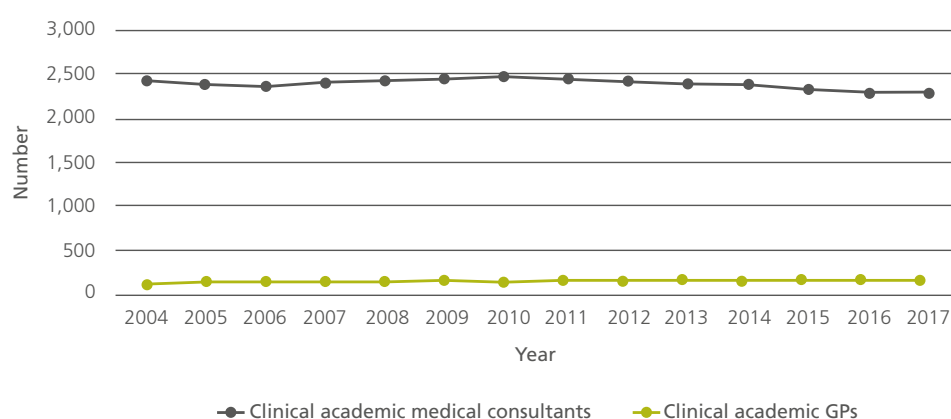


Figure 2: The proportion of clinical academic NHS medical consultants and clinical academic GPs over time

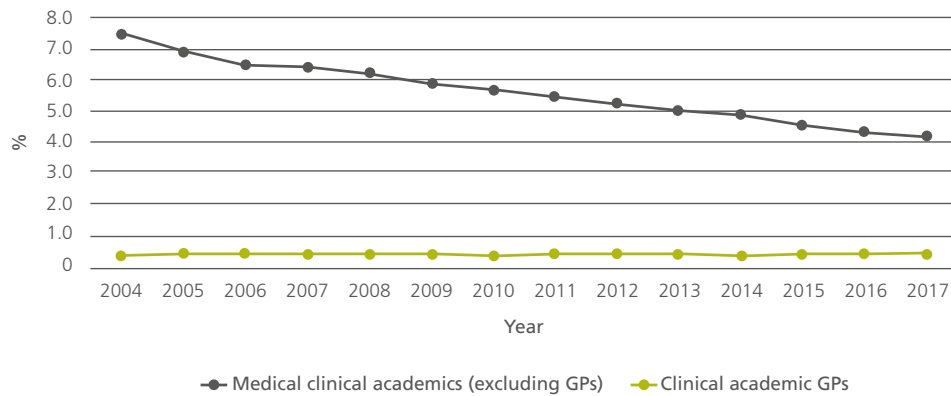


Figure 3A: The proportion of clinical academic medical and GP roles in universities as a percentage of medical and GP consultants over time

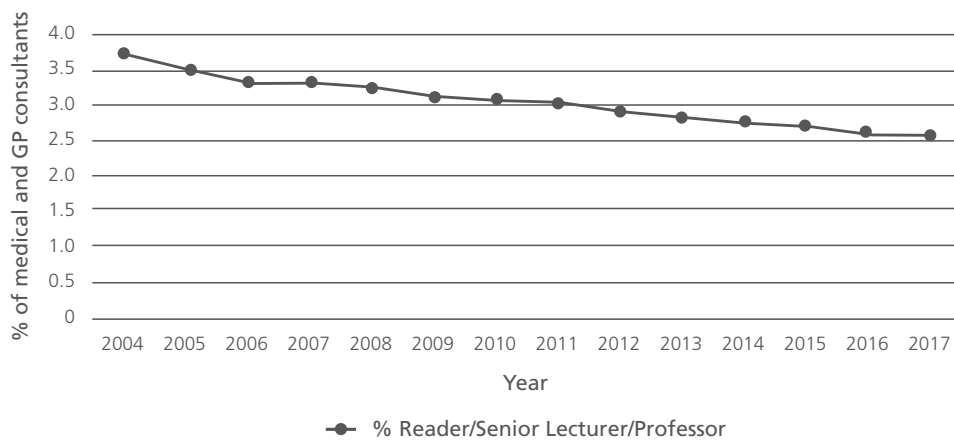
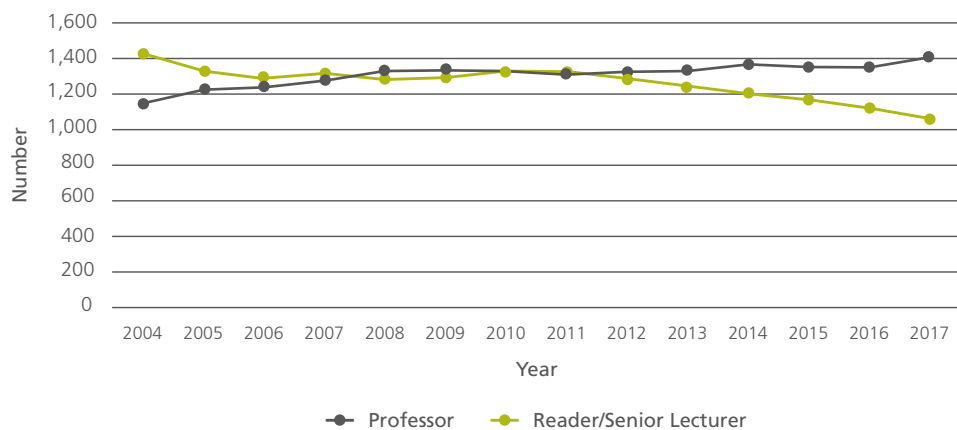


Figure 3B: The number of clinical academic medical and GP roles in universities



Box 4: Examples of initiatives aimed at better integrating research teams across academia and the NHS

Integrating NHS staff into research teams in Leicester

Responding to pressure to increase regulatory interest and consultant morale, in 2015 the University of Leicester made the commitment to work proactively with the NHS on projects of joint mutual benefit. Among a number of initiatives, joint measures were taken to better support clinical trainees and research active consultants, recognising their essential role in teaching and the delivery of the University's academic mission.

Two specific strands of work were undertaken to engage NHS clinicians with the work of the University:

- **Academic Champions** were appointed to act as facilitators for medical students and doctors in training who wished to further their careers by working in collaboration with the University. Academic Champions had honorary University titles and access to University infrastructure to support their activities.
- **Honorary titles** (Lecturer, Senior Lecturer, Associate Professor and Professor) were awarded to NHS consultants and non-medical clinicians. The University rewrote its academic career map and encouraged NHS staff to consider applying for honorary contracts, allowing appropriate recognition within the broad domains of research, teaching and leadership within the NHS.

All clinicians were encouraged to apply, and the schemes were co-promoted in provider Trusts by Medical Directors and the Dean of Medicine. The University also runs a specific annual call for applications for promotion for honorary title holders. Success is recognised at an annual awards ceremony hosted by the University. To date over 100 honorary appointments have been made by the University to clinical staff across the health economy.

To widen access to research for medical students, the student-led Leicester University Medical Research Society has also set up an initiative called LINK, which pairs medical students interested in academic medicine with academics interested in mentoring.⁹⁶ Medical students undertake alongside their studies a short focused piece of research, which can range from laboratory-based basic science research, to hospital-based clinical research and desktop data projects. This initiative provides students with an introduction to academic medicine that would usually not be available to them outside of an intercalated BSc.

Accelerating the translation of research into patient benefit and population health in Glasgow

The University of Glasgow and NHS Greater Glasgow & Clyde (NHSGGC) Health Board have been effective partners since the opening of Glasgow's first teaching hospital in 1794 and enjoy a synergistic partnership that spans teaching, clinical work and research. The two organisations are partners on a wide range of activities, from joint legal governance of clinical trials and shared R&D offices, to the joint development of academic infrastructure at the Queen Elizabeth University Hospital (QEUH). This includes a jointly managed Teaching & Learning Centre, advanced Clinical Research Facilities, an Imaging Centre of Excellence, and a Clinical Innovation Zone with purpose-built industry space. The 'triple helix' partnership between the NHS, University and industry is at the core of all translational activity at the QEUH. Most recently the University of Glasgow and NHSGGC have formalised their relationship through establishing the Glasgow Health Sciences Partnership. The overarching aims of the partnership are to improve health outcomes, deliver better healthcare, generate economic benefits, and ensure that Glasgow is a magnet for recruitment and retention of the best staff.

Currently 1,100 NHSGGC staff have honorary contracts with the University of Glasgow, spanning honorary professorships, honorary clinical senior lecturer and lecturer posts, and clinical research fellowships. Honorary staff are an integral part of the University community and contribute to undergraduate teaching as well as clinical research. The NHS Research Scotland Fellowship Scheme allows newly-appointed consultants to dedicate up to one day a week to research. Undergraduate medical students have multiple opportunities for research exposure including: an intercalated programme; student selected components and clinical elective programmes that encourage research; and active participation in the Academy of Medical Sciences' INSPIRE programme, which enables better engagement of students with research careers. The University of Glasgow also holds a Cancer Research UK MB/PhD programme jointly with the University of Edinburgh, which allows aspiring clinician scientists to undertake medical training alongside a research PhD.

Integrating NHS staff into research teams at King's Health Partners (KHP)

KHP offer adjunct academic appointments to NHS clinical staff, promoting the integration of clinicians into research teams. Adjuncts are able to act as a Principal Investigators on research grant applications and as account holders for research grant awards. They are also able to act as primary supervisors for PhD students, who would be registered within the relevant division, department or faculty at King's College London. Appointments are supported by a 'KHP Passport', which allows adjuncts to work at any of the designated sites within King's Health Partners. Appointees are also granted access to King's College London's email infrastructure and research management tools. Adjunct academic appointments are initially made for five academic years and are renewed subject to review. A formal review of the scheme is planned for 2020, but early anecdotal evidence suggests the scheme has facilitated joint working between research-active NHS staff and academic researchers.

Box 5: Initiatives to provide dedicated time for research

Across healthcare professions

Heath and Care Research Wales (HCRW) Clinical Research Time Award

HCRW's Clinical Research Time Award aims to build research capacity and capability in the NHS by offering NHS Wales staff the opportunity to apply for protected time to engage in research activity.⁹⁷ The scheme funds research time and training for those in primary, secondary or community care or public health, who aspire to become either a Principal Investigator or a Chief Investigator.

NHS Research Scotland (NRS) Career Researcher Fellowships

NRS Career Researcher Fellowships support the breadth of NHS-funded clinical staff in developing a research career within their NHS post.⁹⁸ This includes qualified doctors, nurses, allied health professionals, pharmacists, biomedical/clinical scientists and public health specialists. The award provides funding for protected time to contribute to, conduct and lead clinical research with a view to strengthening the research culture in the NHS and increasing capacity in priority areas.

For consultants

The MRC Clinical Academic Research Partnerships (CARP)

CARP was set up by the MRC in 2018 to provide a flexible new route for research-qualified NHS consultants who are not research active to expand their research skills and experience by engaging with groups and centres of biomedical research excellence.⁹⁹ The scheme provides up to three years' funding to undertake a research project within an existing biomedical research team, including costs for consumables and up to half of the applicant's basic salary to support protected research time.

In nursing, midwifery and the allied health professions

Health Education England (HEE)/ National Institute for Health Research NIHR (NIHR) Integrated Clinical Academic (ICA) Programme

The HEE/NIHR ICA programme provides research training awards to healthcare professionals (excluding doctors and dentists), who wish to develop clinical research careers alongside continued clinical practice and development.¹⁰⁰ Five levels of award are available including: internships, pre-doctoral Clinical Academic Fellowships, Clinical Doctoral Research Fellowships, Clinical Lectureships, and Senior Clinical Lectureships.¹⁰¹ ICA Programme-funded mentorship support is available to Doctoral and Post-Doctoral award holders through the ICA Mentorship scheme. ICA Bridging Schemes are also funded by the ICA Programme to support members of eligible professions who wish to build on their previous academic training and develop proposals for pre- or post-doctoral awards.

NHS 70 @ 70 Senior Nurse and Midwife Research Leader programme

NIHR launched the NHS 70 @ 70 Senior Nurse and Midwife Research Leader programme in May 2019, funding 70 nurses and midwives to undertake a three-year research programme in an effort to further develop an evidence based culture within the NHS's largest workforce.^{102,103} Participants dedicate two days a week to the scheme, increasing the research capacity of nurses and midwives across England, and enabling them to lead on research projects.¹⁰⁴

Research Capacity Building Collaboration (RCBC) Wales

RCBC was created in 2005 to drive an increase in the research capacity and capability of nursing and allied health professional groups (and since 2014 pharmacists) and to contribute towards the development of clinical academic roles.¹⁰⁵ Six Welsh university nursing and allied health departments cooperate to provide shared infrastructure and support for research fellowships across the research trajectory, from 'First into Research' opportunities, Masters degrees, doctoral and postdoctoral studies, to a senior health career research fellowship.¹⁰⁶

In primary care and dentistry

NIHR In Practice Fellowships (IPFs)

NIHR IPFs are available for fully qualified GPs, as well as General Dental Practitioners and Community Dentists, who are interested in undertaking pre-doctoral academic training.^{107,108} The IPF supports the academic component of two-year 50% clinical, 50% academic posts. The IPF award provides funding for salary, a personalised programme of academic training and conference attendance. The IPF is designed to equip the awardee with the skills and experience to prepare an application for a competitive, peer-reviewed doctoral level research training fellowship.

Primary Care Research Incentive Scheme (PiCRIS)

PiCRIS was established to increase research capacity in primary care in Wales, thereby supporting high quality research and creating a strong primary care research base and culture.¹⁰⁹ This funding scheme offers support, mentorship and funding to general practices across Wales, incentivising them to become research active and embed research activity in their daily practice.

Box 6: Leadership schemes

The Council of Deans of Health Student Leadership Programme

The Student Leadership Programme is a partnership between the Council of Deans of Health and the Burdett Trust for Nursing.¹¹⁰ The programme aims to promote and develop leadership skills among the future nursing, midwifery and allied health professional workforce by working with first and second year undergraduates, and first year postgraduate pre-registration students. The programme has been co-designed with students to ensure it focuses on areas not covered in current pre-registration curricula.

The King's Fund clinical leadership schemes

The King's Fund offers four clinical leadership programmes aiming to support emerging and existing leaders across various levels of clinical seniority.¹¹¹ The programmes are designed for: medical directors and nursing directors; clinical directors and lead clinicians; consultants; and emerging clinical leaders, from all professional backgrounds.

The Academy of Medical Sciences' Future Leaders in Innovation, Enterprise and Research (FLIER) scheme

The Academy has recently launched a new leadership programme, FLIER, which aims to develop the most gifted and capable leaders of the future who can create collaborations across academia, industry, the NHS and government, and drive innovation and its uptake and spread across the NHS.¹¹²

Box 7: Incorporation of research time in posts to improve recruitment

Creation of posts with increased time for research to improve the recruitment of consultant psychiatrists

In response to difficulties in recruiting consultant psychiatrists and the heavy reliance on locums to fill vacant posts, King's College London and South London and Maudsley NHS Trust are developing physician scientist/consultant psychiatrist posts with increased time for Supporting Professional Activities (SPAs).¹¹³ Consultant posts traditionally comprise two and a half programmed activities per week for SPAs, equating to six hours per week, with the rest dedicated to direct clinical care. The proposed posts comprise four SPAs, equating to two days a week, for research activities. The intention is for two advertised posts to be linked, with the two post holders undertaking research activities on distinctive days and overlapping one day in the clinic. It is hoped that these new posts will help not only with recruitment, but also with job satisfaction and staff retention, ultimately reducing the reliance on locums and its associated cost. The posts would be closely integrated with research groups at King's College London, thereby ensuring that academic research is informed by clinical need while at the same time enhancing the Trust's capacity to perform translational research.

NIHR Academic Clinical Fellowships (ACFs) in primary care

NIHR ACFs are specialty training posts that incorporate academic training.¹¹⁴ Both medical and dental ACFs spend 75% of their time undertaking specialist clinical training and 25% of their time undertaking research training. ACF posts in primary care receive a consistently higher application ratio compared to standard GP posts (on average 6 applications per ACF post in contrast to 1.3 applications for traditional clinical posts), suggesting that the introduction of a research component may help to attract staff to understaffed specialties.¹¹⁵

Box 8: Integrated clinical academic training schemes in the UK

To remedy the absence of a formal training pathway for academic medicine, as highlighted in the Walport report, the NIHR established the Integrated Academic Training (IAT) Pathway.^{116,117} This pathway, that has since become a central pillar for all clinical academic trainees, provides a structured division of research and clinical practice with defined entry and exit points, and a clear route for progression. To complement the IAT in England, academic trainees across the UK can access the Wales Clinical Academic Track (WCAT), the Edinburgh Clinical Academic Track and Scottish Academic Training (SCREDS). These competitive schemes are underpinned by a consortia of research funders who collectively support each stage of academic training.^{118,119,120}

Box 9: Shape of Training Review

The Shape of Training Review supports flexible training, calling for a programme structure that is flexible enough to allow trainees to move in and out of clinical training while meeting the competencies and standards of each element of their course.¹²¹ The aim is to ensure doctors are able to work more flexibly in this pathway, and to encourage more doctors to think about building academic research into their careers. This would allow trainees to benefit from a range of research opportunities, secure in the knowledge that they can return to the programme at the stage of training at which they left.

Box 10: Examples of Joint Research Office functions

Newcastle Joint Research Office (NJRO)

The NJRO was established in 2006 between The Newcastle upon Tyne Hospitals NHS Foundation Trust (Trust) and Newcastle University (University) to support researchers in the development, implementation and delivery of world-class experimental, translational and clinical research.¹²² Through the partnership, the Trust acts as sponsor for all University research requiring access to its patients. The NJRO team interfaces with colleagues across the Trust and University to support researchers through funding development, governance and regulatory compliance, application submission, post-award contracting and intellectual property, and post-award project management.¹²² The Systems Leadership approach to research is essential in ensuring the partnership delivers the best research for patient outcomes.

The successful development and clinical translation of pronuclear transfer (PNT) – the IVF-based technique known as ‘mitochondrial replacement’ to prevent transmission of mitochondrial DNA disease from mother to child – is a compelling example of world class research achieved by providing support for interdisciplinary research collaborations between the Trust and University. The location of the research group that pioneered this technique within the NHS Newcastle Fertility Centre enabled unprecedented access to human eggs donated specifically for research. NHS consultant gynaecologists were instrumental in the establishment of the egg donation programme, as well as in navigating the UK regulatory landscape to obtain a license to fertilise donated eggs for research purposes. Following a change in UK law in 2015, the Newcastle Fertility Centre can now offer PNT treatment to families at risk of transmitting serious mitochondrial DNA disease to their children. A follow-up study of children born following PNT treatment is currently underway. Overcoming major scientific, logistical and regulatory hurdles could not have been accomplished without the robust infrastructure provided by the NJRO to facilitate and support collaboration between the Trust and University.

Imperial College Joint Research Office (ICJRO)

ICJRO was set up in 2009 by combining the Research Services team in the Faculty of Medicine with the R&D support team in Imperial College Healthcare NHS Trust under one umbrella to offer a comprehensive research support service for both College and Trust staff.¹²³ The ICJRO serves the research community across the Imperial College Academic Health Science Centre. Organised into specialist teams, ICJRO staff facilitate the management of research grants, contracts and EU projects in the Faculty of Medicine, and clinical studies in Imperial College Healthcare NHS Trust.¹²⁴

University of Sheffield Clinical Research & Innovation Office (CRIO)

The CRIO is a partnership between Sheffield Teaching Hospitals NHS Foundation Trust and the University of Sheffield. It aims to support researchers to set up studies quickly and efficiently by delivering high quality research support, assistance and education with the University of Sheffield’s Research Services, and to provide expert advice on research design and analysis.¹²⁵

Liverpool Health Partners Single Point of Access to Research and Knowledge (SPARK)

SPARK is a joint research service made up of 13 organisations including nine NHS organisations and four University partners across the Merseyside and Lancashire counties. It aims to act as a single point of contact to provide practical help and support to research projects. SPARK specifically provides support and advice around study costings, sponsorship, clinical research governance, contracts and funding applications.^{126,127}

University College London Hospital and University College London Joint Research Office (UCLH/UCLJRO)

Established in 2005, the JRO works across UCL and UCLH, including the NIHR UCLH Biomedical Research Centre, to ensure that the clinical translational research portfolio is supported by the right expertise and sustained by effective and efficient systems for meeting quality and safety standards, regulatory requirements and performance targets for research. Every year, the JRO supports an average of 300 new studies through to initiation, including an average of 130 new studies which require sponsorship from UCL or UCLH. The JRO assists with the establishment of clinical research studies by functioning as a single portal for academic researchers and clinicians to access support for their research. The JRO has instilled a single portfolio ethos which promotes comprehensive support for the partnership’s research, proportionality in research management systems and risk assessments, and an ability to be nimble at the UCL-UCLH interface, finding solutions to questions around sponsorship, research funding and other aspects of research management that enable research projects to progress as smoothly as possible. The JRO has expertise in protocol development, research design, costing and contracting, and regulatory submissions, as well as in intellectual property, and patient and public involvement and engagement. Close partnership working with other research support functions at UCL and with clinical departments and service support departments at UCLH is a crucial part of what the JRO does. The JRO contributes to internal and national policy development, and represents the clinical research portfolio at committees and boards within UCL and UCLH.¹²⁸

The University of Oxford-Oxford University Hospitals Joint Research Office (OU-OUH JRO)

The OU-OUH JRO is a partnership between the University of Oxford and Oxford University Hospitals NHS Foundation Trust. It was established in 2011 to facilitate medical research in Oxford by improving communication and streamlining processes through shared knowledge and expertise between the University and the OUH. The circa 100 staff in the JRO are divided roughly equally between the OUH's R&D teams and University teams. These teams provide specialist research support throughout the study life-cycle across a broad spectrum of areas including governance, finance, contracts, grants and business development.¹²⁹

The JRO teams, originally established in co-located office space provided by the OUH to promote joint working and shared processes, are now spread over three geographical areas due to expansion of the JRO and the need for a presence in the various campuses. However, the cohesion is maintained through a robust structure of leadership and shared processes. Governance arrangements for JRO oversight and reporting are provided via the OU-OUH Joint R&D Committee, which reports to the OUH-University Joint Executive Group, ensuring that joint R&D issues are visible to senior Board-level leadership in both the OUH and the University.

The JRO teams have worked together to streamline set-up and approval processes, enabling a remarkable threefold increase – from 672 to 1,908 – in the number of studies hosted by the OUH during the last decade. In 2018-19, over 32,000 OUH patients were recruited to studies on the NIHR Clinical Research Network portfolio, the second highest figure for any Trust in England. The OUH recruited over 4,600 participants to commercial contract studies in 2018-19, representing 10% of the national total and more than any other single Trust in England.

The JRO has also been instrumental in driving forward closer collaboration between the University and the OUH for mutual benefit across other areas. These include intellectual property, which has resulted in the OUH, as an NHS Foundation Trust, becoming an equity shareholder in several spin-out companies, and the development of models to redistribute income to facilitate studies involving staff and other resources from both the University and the OUH. The joint development of shared IT systems has transformed the way studies are overseen and the combined efforts of the JRO's teams have played a crucial role in supporting the growth of the highly successful NIHR Oxford Biomedical Research Centre.

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