The Academy of Medical Sciences

September 2021

Academy of Medical Sciences representation to spending review 2021

Executive Summary

The last 18 months have been both successful and challenging for UK medical research. There are opportunities and challenges ahead – to build on strengths and address long-term weaknesses. This summary provides details on how the Government might take these opportunities and address these challenges as well as providing key supporting evidence. Further details, evidence and case studies can be found in the supporting text.

Principles

The Academy of Medical Sciences (AMS) recommends the following principles to guide UK Government investment in medical research at this Spending Review:

- **Increase certainty** through long-term, stable and predictable funding
- **Maintain balance** across the UK's interconnected research ecosystem, protecting the whole system by ensuring no key parts fall behind
- **Utilise research** to level up across the UK and enhance the UK's international partnerships and reputation

Policy recommendations

AMS makes the following themed policy recommendations for this Spending Review:

Invest towards 3%

- **Set out clear and consistent annual increases to public investment in R&D to reach £22bn annually by 2024/25**
- **Plan to increase total investment in R&D to 3% of GDP**, setting 2.4% by 2027 as an intermediate goal

Invest in the fundamentals of UK medical research

- Commit to **long-term, real terms increases to the core research budgets of the seven research councils**
- **Reverse the real terms decline in quality-related (QR) funding** to ensure the UK's world-class university sector can sustainably continue to drive advances in research
- **Uplift the NIHR budget** – in real terms, over the long-term – in line with other parts of the science budget
- **Work with the UK's medical research charities** to ensure they can continue to play a unique and vital role in the research ecosystem, including by bolstering the CRSF

Invest in NHS research and development

- **Fund an NHS research pilot** where a proportion of consultants working in the NHS are offered a contract that includes dedicated time for research

Unlock medical research in business

- **Renew investment in the Biomedical Catalyst, enhance R&D tax credits and unlock pension funds** to invest in innovative early-stage life sciences firms

Invest in medical research to level up across the UK

- **Ensure the UK Shared Prosperity Fund** and any other similar initiatives can support research and innovation across the UK to promote regional growth

Invest in collaboration and access

- **Commit to covering the cost of UK participation in Horizon Europe** without cutting the existing science budget
- **Reinvest in global Research Development and Innovation (RDI) partnerships**, providing funding and clarity as soon as possible to maintain the UK's relationships and reputation
- **Assess the impact of the cost of the UK's visa offer** on the movement of global research staff to the UK, especially in comparison to other leading research nations

Why invest?

AMS highlights the following key evidence, supplemented throughout this document, in support of our recommendations for investment:

Government investment in medical research leverages private investment

- **Each pound of Government investment** in R&D crowds in roughly two pounds of private investment.[1]
- Recent analysis shows that **if Government were to delay the £22bn target by three years it would lose leveraged private investment of over £11bn by 2027/28** and miss the target of 2.4% of GDP invested in R&D by 2027.[2]

Public investment is needed to create certainty and stability for researchers

- A report in January 2020 found that **only 29% of early career researchers** feel secure pursuing a research career.[3]
- To reach the 2.4% target, **the R&D workforce in the UK** will need to increase by up to 50%.[4]

Medical research is a key area where Government can "deliver the people's priorities over the next three years"[5]

- Polling by Public First found that medical research was by far the most popular discipline for R&D investment with the public, with **57% of respondents** ranking it among their top three priorities.[6]

Medical research also offers excellent return on investment

- Every £1 of public investment in medical research delivers **a return equivalent to around 25p every year, forever**[7]
- The UK life sciences industry employs over 256,000 people and generates a **turnover of £80.7bn**.[8] In 2019, the pharmaceuticals sector performed more R&D than any other sector and was the **largest employer of people in R&D related roles** (29,000).[9]

The Medical Research Council (MRC) funds lifesaving and economically valuable work

[1] The relationship between public and private R&D funding (publishing.service.gov.uk)
[2] CaSE | Delaying R&D target would cost UK billions in private investment (sciencecampaign.org.uk)
[3] What researchers think about the culture they work in (wellcome.org)
[4] Reaching 2.4%: Securing the research talent of tomorrow - GOV.UK (www.gov.uk)
[5] Chancellor launches vision for future public spending - GOV.UK (www.gov.uk)
[6] Advocating for R&D Investment (wellcome.org)
[7] Wellcome Trust (2017) National Institute for Health Research, Academy of Medical Sciences, Medical Research Council, Arthritis UK Medical research: What's it worth?
[8] Bioscience and Health Technology Sector Analysis 2019 (publishing.service.gov.uk)
[9] Research & Development spending (parliament.uk)

- **The RECOVERY trial (see case study 3) and the UK Biobank (see case study 2)** are just two examples of the work made possible by funding through the MRC, which have saved lives and leveraged funding.

Research in the UK's world-class university sector is a unique national asset

- **The UK's university sector is world-class**, with 4 of the world's top 20 universities based in the UK, including 5 of the top 20 universities for clinical and health research.[10]
- The UK has the **highest per-capita share** of the top 1% most frequently cited life sciences publications worldwide.[11]

The National Institute for Health Research supports the economy and levelling up

- Economic analysis has demonstrated that between 2016/17 and 2018/19, research supported by the NIHR CRN generated an estimated **£8bn of gross value added** (GVA) and 47,467 full time equivalent (FTE) jobs.[12]
- In 2018/19, **every single NHS Trust in England** took part in research, with over 1 million clinical research participants, demonstrating the key link between health research and the health of patients in all parts of the country.[13]

Medical research charities play a unique role in the UK's funding ecosystem

- UK medical research charities have provided **£14.5 billion of funding** since 2011 and **leveraged a further £2.7 billion**.[14,15]
- In 2019, members of the Association of Medical Research Charities (AMRC) provided stipends for more than 1,700 PhD students as part of their wider support for the salaries of **over 17,000 researchers**.[16]

Research in the NHS is integral to advancing the nation's health and wealth, as well as enhancing the sustainability of the NHS

- **The NHS-delivered RECOVERY trial** (**see case study 3**) identified dexamethasone as a COVID treatment, estimated as of March 2021 to have saved 1 million lives worldwide, as well as many millions of pounds in avoided costs of alternative treatments.[17,18]
- **Research active hospitals have better patient outcomes**, including lower mortality rates, with the benefits of research extending beyond those directly participating in research.[19,20,21]
- Evidence suggests that **engaging in research may improve clinicians' job satisfaction, can boost morale and can reduce burnout**.[22,23,24,25,26]

Research is central to the UK's relationships and reputation on the global stage

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[10] World University Rankings 2022 by subject: clinical and health | Times Higher Education (THE)
[11] uuk-he-vision.pdf (universitiesuk.ac.uk)
[12] https://www.nihr.ac.uk/documents/partners-and-industry/NIHR_Impact_and_Value_report_ACCESSIBLE_VERSION.pdf
[13] News: Record number of patients take part in clinical research | NIHR
[14] Our sector's footprint | Association of Medical Research Charities (amrc.org.uk)
[15] 4) Stimulating further research via new funding or partnerships | Association of Medical Research Charities (amrc.org.uk)
[16] Association of Medical Research Charities (2020) COVID-19: The risk to charity-funded researchers, https://www.amrc.org.uk/covid-19-the-risk-to-charity-funded-researchers
[17] NHS England » COVID treatment developed in the NHS saves a million lives
[18] RECOVERY trial: The potential health and economic impact of dexamethasone treatment for patients with COVID-19 - HDR UK
[19] Ozdemir BA, *et al.* (2015). *Research Activity and the Association with Mortality*. PLoS One 10, e0118253.
[20] Boaz A, *et al.* (2015). *Does the engagement of clinicians and organisations in research improve healthcare performance: a three-stage review.* BMJ Open 5, e009415.
[21] McManus RJ, *et al.* (2008). *How representative of primary care are research active practices? Cross-sectional survey*. Family Practice 25, 56–62.
[22] Lambert TW, Smith F, Goldacre MJ. *Making clinical academic careers more attractive: views from questionnaire surveys of senior UK doctors.* JRSM Open. 6(8): 2054270415602644, 2015.
[23] Dale J, Potter R, Owen K, Parsons N, Realpe A, Leach J. *Retaining the general practitioner workforce in England: what matters to GPs? A cross-sectional study.* BMC Family Prcatice. 16:140, 2015.
[24] Watson C, King A, Mitra S, Shaaban AF, Goldstein AM, Morowitz MJ, Warner BW, Crombleholme TM, Keswani SG. *What does it take to be a successful pediatric surgeon-scientist?* Journal of Pediatric Surgery. 50(6): 1049-52, 2015.
[25] Community Research (2018). *Adapting, Coping, Compromising research*. https://www.gmc-uk.org/-/media/documents/adapting-coping-compromising-research-report-79702793.pdf
[26] Shanafelt TD, et al. (2009). Career Fit and Burnout Among Academic Faculty. Archives of Internal Medicine 169(10), 990–995.

- **Around 57% of UK research outputs are produced in collaboration with an international co-author** and 50% of all research-only staff and 35% of postgraduate research students in our universities are from outside the UK.[27]
- The UK's visa offer to global research staff is **significantly more expensive** than other leading research nations (see Table 3).

Government priorities

The recommendations listed support the Government's priorities for the Spending Review in the following ways:

Ensuring strong and innovative public services

- Investing in biomedical and health research – through the NHS, the UK's world-class higher education system, the NIHR and the MRC – will help make people's lives better.

Levelling up across the UK

- R&D is a driver of innovation and private investment, not least in specific regions, which can be boosted through the UK Shared Prosperity Fund and other similar schemes. The NHS is itself a powerhouse for testing, evaluating and delivering innovation for health, which specifically enables access to patients across the country, from all backgrounds. Building research capability across the whole NHS – not just in centres of established excellence – and enabling inclusive recruitment to clinical trials can bring better health, more equal health and more cost-effective delivery of healthcare across the UK.

Leading the transition to Net Zero

- As we tackle climate change, the UK Government should lead the world in ensuring the benefits of the transition to Net Zero are maximised for patients and the public in the UK and globally, by considering the health co-benefits of the transition in all areas of policy.

Advancing Global Britain

- R&D is central to the UK's reputation and relationships internationally. By making the most of the opportunity presented by UK association to Horizon Europe, reinvesting in global partnerships and continually assessing the attractiveness of the UK's visa offer to global research staff, this Government can advance a Global Britain.

Delivering the Plan for Growth

- Setting out clear, consistent annual increases to public investment in R&D – reaching £22bn per year by 2024/25 – and pushing to raise total investment to 3% of GDP, will help underpin an infrastructure and innovation revolution in the UK. Keeping this investment balanced across the UK's diverse research ecosystem – across the Research Councils and NIHR, QR funding and the work of our medical research charities – will be key to cementing the UK as a scientific superpower. Moreover, public investment, allied with attractive R&D tax incentives will leverage private investment in innovative early-stage life sciences firms.

[27] uuk-he-vision.pdf (universitiesuk.ac.uk)

Introduction

Medical research has been at the centre of the UK's response to COVID-19, from our public health response and understanding the virus, to developing innovative diagnostics, treatments and vaccines. The balance of basic research in our universities, clinical research in the NHS, and collaborative partnerships with industry has been key.

The recent success of UK science has been a lesson in long-term investment, as years of previous funding was shown to have created the conditions for quick and effective delivery of benefits to patients and the public. As the Prime Minster noted in July 2021:

> *"The single most important thing that we have learned…is the massive benefits to our country, to our society and to our economy of investing in science. You could not have a clearer object lesson than the discovery of the Oxford vaccine and the impact that is now having on our ability to open up our society in way that otherwise, frankly, we could not."*[28]

Medical science, and health research more broadly, will be central to our collective recovery – not just by offering a path out of the pandemic, enabling the UK economy to fully restart, but by directly stimulating the economy across the UK through new jobs, investments and ultimately long-term health benefits. Every £1 of public investment in medical research delivers a return equivalent to around 25p every year, forever.[29]

We welcome this Government's ambition to ensure the UK is a 'science and technology superpower', and the central place this has in government strategies: from the Plan for Growth to the Integrated Review, to the various strategies and commitments for investment that accompany them. Delivering on those commitments is now crucial.

The pandemic has taken a toll on the UK's health research, development and innovation (RDI) environment: stalling researchers' careers; diminishing funds for lifesaving and life-improving projects; postponing clinical trials; and ultimately delaying improved outcomes for patients. To protect against long-term damage, continue realising the benefits of medical research for all in the years to come, and build our resilience against future crises, it is crucial that Government invests strategically now.

Long-term, stable and predictable public investment is needed to enable quality research, create sustainable research careers and attract international talent. Certainty will also help to leverage the private investment which will be crucial for achieving the Government's ambition of raising total UK investment in research and development (R&D) to 2.4% by 2027, and 3% in the longer term.

Investing in medical research is a key area where Government can "deliver the people's priorities over the next three years"[30]. In all cases, public investment in UK R&D must be guided by the need to ensure the UK's research culture is inclusive and supportive of a diverse workforce, and that investment is guided by meaningful engagement with the public and patients to ensure that research priorities are informed by their needs.

[28] https://committees.parliament.uk/oralevidence/2308/default/
[29] Wellcome Trust (2017) National Institute for Health Research, Academy of Medical Sciences, Medical Research Council, Arthritis UK Medical research: What's it worth?
[30] Chancellor launches vision for future public spending - GOV.UK (www.gov.uk)

Invest towards 3%

1. The Academy of Medical Sciences supports this Government's ambition to ensure economy-wide investment in research and development (R&D) reaches 2.4% of GDP by 2027.[31] **However, this is now a race to below the OECD average**.[32] On an individual basis, comparable countries are already ahead of the UK on this path, with much higher investment levels, such as France (2.2%), China (2.2%), the US (3%) and Germany (3.1%) – **see Table 1**.[33]

2. To have "secured our status as a Science and Tech Superpower by 2030",[34] Government must pursue a more ambitious target of raising total investment in R&D to 3%, with 2.4% by 2027 as an important stepping stone.

> Recommendation: **Plan to increase total investment in R&D to 3% of GDP, setting 2.4% by 2027 as an intermediate goal.**

3. The first step towards 2.4%, and 3% in the longer term, will be delivering on the commitment to increase annual public investment in R&D to £22bn,[35] and, crucially, doing so by 2024/25.[36]

4. Each pound of Government investment in R&D crowds in roughly two pounds of private investment,[37] and increasing private investment will be crucial in reaching the 2.4% target.[38] Importantly, **the leveraging effect of public investment in R&D is most substantial within the first year, while the majority of private investment is crowded in by the fifth year**.[39] By increasing public investment sooner rather than later, this Government can make achieving 2.4% by 2027 more likely.

5. Recent analysis shows that **if the Government were to delay meeting the £22bn target by three years it would lead to a loss of leveraged private investment of over £11bn by 2027/28**. It would also mean missing the target of 2.4% of GDP invested in R&D by 2027.[40]

> Recommendation: **Set out clear and consistent annual increases to public investment in R&D to reach £22bn annually by 2024/25.**

6. Science thrives on certain and sustained investment. Providing the steps to £22 billion will help to deliver the full benefits of Government funding.

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[31] Build Back Better: our plan for growth (HTML) - GOV.UK (www.gov.uk)
[32] Research and development (R&D) - Gross domestic spending on R&D - OECD Data
[33] Main Science and Technology Indicators - OECD
[34] Global Britain in a Competitive Age: the Integrated Review of Security, Defence, Development and Foreign Policy - GOV.UK (www.gov.uk)
[35] UK innovation strategy (publishing.service.gov.uk)
[36] Budget 2020 - GOV.UK (www.gov.uk)
[37] The relationship between public and private R&D funding (publishing.service.gov.uk)
[38] The business sector accounts for roughly two thirds of all UK R&D expenditure Gross domestic expenditure on research and development, UK - Office for National Statistics (ons.gov.uk)
[39] The relationship between public and private R&D funding (publishing.service.gov.uk)
[40] CaSE | Delaying R&D target would cost UK billions in private investment (sciencecampaign.org.uk)

7. Clarity on increased public investment in R&D will have a positive impact on wider economic growth, lending confidence to private investors and leveraging further funding. Each pound of Government investment in R&D creates roughly £7 of net benefits.[41] The Government's own modelling suggests that an extra £15bn in annual R&D spending will result in a £30.5bn increase in annual GDP and 80,000 extra jobs in 2027.[42] The decision of Merck Sharp & Dohme (MSD) to invest roughly £1bn in a new Discovery Centre in London (**see case study 1**) is just one example of how long-term public investment in the excellence of our existing research base – including in universities and research centres – paves the way for private investors, not least by reinforcing the fundamentals of an attractive research environment, such as talent and infrastructure.

8. Clear steps to reach £22bn by 2024/25 will also help create conditions that lead to good research. The confidence to pursue long-term research was a vital precursor to the creation of the Oxford/AstraZeneca vaccine, as well as projects like the UK Biobank (**see case study 2**), whose development over time allowed them to respond quickly to support the research and policy community – including the highest decision-makers – to provide critical evidence for the pandemic response.[43] As the Government's R&D Roadmap notes:

> *"The UK has a deep and broad research base with demonstrable excellence across many areas…This is the result of sustained investment over many years into this ecosystem"*[44]

9. Short-term settlements for science, however, have the opposite effect. As the Government's R&D Roadmap points out:

> *"short-term spending settlements can limit people's ability to develop long-term plans… [We] accept the need to reverse the decline in funding for the long-term, fundamental research on which the entire system depends"*[45]

Certainty needed for recovery

10. Certainty will be particularly important for enabling sustainable careers in research. The pandemic has affected many research careers, from paused research and gaps in CVs to difficulty restarting projects. But in many cases the pandemic only widened existing cracks, including geographical disparities and inequalities in gender and race.[46]

11. A report in January 2020 found that only 29% of early career researchers feel secure pursuing a research career.[47] Another recent survey of over 500 charity-funded early

[41] The relationship between public and private R&D funding (publishing.service.gov.uk)
[42] Research and Development: macroeconomic modelling of 2.4% target: analysis with the E3ME model (publishing.service.gov.uk)
[43] Quote from Sir Patrick Vallance FMedSci, Our impact (ukbiobank.ac.uk)
[44] UK Research and Development Roadmap (publishing.service.gov.uk)
[45] UK Research and Development Roadmap (publishing.service.gov.uk)
[46] 74955141 (acmedsci.ac.uk)
[47] What researchers think about the culture they work in (wellcome.org)

career researchers found that 40% are considering leaving research due to funding concerns since COVID-19 hit the UK.[48] **This is all in the context of estimates that, to reach the 2.4% target, the R&D workforce in the UK will need to increase by up to 50%**.[49] We risk losing the current generation of early career researchers if they are not able to access secure senior posts and go on to become the science leaders of the future.

12. Investing now, with clarity and stability, will help create the certainty needed for researchers to begin or continue sustainable careers in UK research. In turn, this will underpin every other aspect of public investment in UK R&D. As noted in the Government's R&D People and Culture Strategy:

> *"To match our ambitions for R&D we estimate the R&D sector will need at least an additional 150,000 [people] by 2030 to sustain the UK's target of 2.4% research and development intensity"*[50]

13. We support the analysis of the Government's R&D Roadmap ahead of the 2020 spending review:

> *"The COVID-19 pandemic also has shown us the fragility of the funding system…and looking towards the Spending Review [2020] we will consider its sustainability so that researchers and businesses can make long-term, ambitious plans."*[51]

14. This sustainability and certainty is sorely needed for the workforce that underpins all UK R&D, and also for research itself. The Academy's report on the impact of COVID-19 on biomedical research careers highlighted concerns of gaps in support for longitudinal research, non-COVID related diseases, and basic biomedical science.[52]

15. **This spending review is a crucial moment to ensure that researchers and businesses will be able to make the kind of long-term, ambitious plans that will help cement the UK as a science superpower and deliver on the Government's Plan for Growth.**

[48] https://committees.parliament.uk/publications/5426/documents/54219/default/
[49] Reaching 2.4%: Securing the research talent of tomorrow - GOV.UK (www.gov.uk)
[50] R&D People and Culture Strategy (publishing.service.gov.uk)
[51] UK Research and Development Roadmap (publishing.service.gov.uk)
[52] 74955141 (acmedsci.ac.uk)

Table 1: GDP invested in R&D by leading scientific nations, 2017 to 2019[53]

Country	**2017 Investment in R&D (% of GDP)**	**2019 Investment in R&D (% of GDP)** (green = increase since 2017; black = no change since 2017; red = decrease since 2017)
Israel	4.69	4.93
Korea	4.29	4.64
Japan	3.17	3.20
Germany	3.05	3.19
United States	2.85	3.07
OECD average	2.35	2.48
France	2.20	2.20
United Kingdom	1.68	1.76
Canada	1.69	1.59

[53] Main Science and Technology Indicators - OECD

Case study 1 – MSD Discovery Centre

In 2017, at the launch of the UK Industrial Strategy, multinational pharmaceutical company Merck Sharp & Dohme (MSD) announced a highly significant investment in UK life sciences: a commitment to establishing a ~£1bn discovery research centre and head office in central London. The Centre will focus on accelerating research efforts for diseases of ageing, particularly for neurodegenerative diseases in the short-term, with the scope growing and advancing over time.

Construction of the complex is expected to start in early 2022 and be completed by 2025, when it will become home to approximately 800 jobs across discovery science and head office teams (also encompassing regional clinical, business development and licensing, and regulatory teams).

The US headquartered company opted for the UK in a highly competitive global environment. Dr Fiona Marshall FMedSci FRS, Senior Vice President: Head of Discovery, Preclinical and Translational Medicine at MSD, is clear about the differentiators that impacted the decision to invest in the UK and those factors that drive decision making now.

"The greatest factor in the UK's favour as a destination for scientific research remains the ability to attract and retain leading talent. London offers connectivity to all parts of the UK, meaning the talent pool is much wider. We recently recruited for data scientist roles in both our UK and US locations, and the UK role had a strikingly higher level of high-quality CVs." – Dr Fiona Marshall FMedSci

Strong geographical connectivity has also allowed MSD to establish promising collaborations with academic centres, research consortia and biotech companies in the UK and Europe, including: Our Future Health; the Francis Crick Institute; Kings College London; Genomics England; Almac; the European Institute of Ageing; and the Dutch Government. However, more must be done to encourage permeability across academia and industry to aid collaboration and develop scientific leaders (see the Academy of Medical Sciences' report on enhancing the NHS-Academia interface[54], and their FLIER programme for developing cross-sectoral scientific leaders).[55]

For MSD, the UK's reputation for research excellence, upon which so much of the appeal to investors hinges, is due in large part to collaborative approaches across Europe. International research collaborations, notably Horizon Europe, are critical to this (**see section 8**).

[54] Enhancing the NHS-academia interface | The Academy of Medical Sciences (acmedsci.ac.uk)
[55] FLIER - leadership programme | The Academy of Medical Sciences (acmedsci.ac.uk)

Case study 2 – UK Biobank

UK Biobank is a large-scale biomedical database and research resource containing in-depth genetic and health information from half a million UK participants: people aged 40-69 who agreed to join the study during 2006-10. The database, which is regularly augmented with additional deidentified data, is globally accessible to approved researchers and scientists undertaking vital research into the most common and life-threatening diseases. UK Biobank's unique and ever-growing research resource is enabling novel and important scientific discoveries in the prevention, diagnosis and treatment of many conditions of middle and old age.

Since the UK Biobank resource was opened for research use in April 2012, over 23,000 researchers from more than 90 countries have been approved to use it and more than 2,400 peer-reviewed papers that used the resource have now been published. During the COVID-19 pandemic alone, 777 research groups accessed data for COVID-19 research. This generated 260 published papers, which were cited over 3,200 times and attracted over 42,000 mentions on social media, blogs and mainstream news.

Its great success is testament to the vision of several research funders - most notably the Medical Research Council, National Institute for Health Research, Wellcome Trust and a collection of medical research charities. These funders understood the significance of advances in genomics and that information from such a database could ultimately lead to improved diagnosis, treatment and prevention strategies for the most devastating diseases, benefiting millions of people in the UK and around the world.

This long-term public funding for UK Biobank has since leveraged more than five times the contribution of Her Majesty's Government (HMG) from industrial and charitable funders as companies around the globe look to make the most of this world-leading biomedical resource. Since 2016, £228m of funding has been leveraged from industry including 17 pharmaceutical, diagnostics and informatics companies across the world to further develop the UK Biobank resource.

UK Biobank has transformed global understanding of the role that genetics play in many rare and life-threatening diseases. For example, Polygenic Risk Scores, developed as a result of genotyping data in UK Biobank, combine the effects of thousands of genetic variants into a number which reflects how susceptible an individual is to a given disease. The development and implementation of Polygenic Risk Scores is now directly influencing treatment planning in the NHS and is one of the most important discoveries enabled by UK Biobank.

This work paved the way for the creation of a private sector led consortium, comprising the world's largest biopharma companies, to perform Whole Exome Sequencing on all 500,000 UK Biobank participants, which has already enabled the identification of novel genetic targets across a wide range of human diseases and traits, such as obesity and diabetes. This was followed by the creation of a £200m public-private consortium to perform Whole Genome Sequencing on the entire UK Biobank cohort. This is set to be released in full in 2022 and will be the most detailed genomics database in the world.

"As a result of public funding over the last 20 years, the private sector is now partnering extensively with UK Biobank. It's difficult to get private funding at the start of a project like this, it is considered too risky, but now the resource exists and is demonstrating its value, it has become a cost-effective way for the private sector to invest. And we're attracting global investment because we're 15 years ahead of anything similar." – Professor Sir Rory Collins FMedSci

Invest in the fundamentals of medical research

16. Medical research delivers health benefits across the UK both directly, by advancing our understanding of the most effective health interventions (**see box 1**), and indirectly, for example as shown by evidence that patients treated in research active hospitals have better health outcomes (see section 4).

17. Investing in medical research is a key area where Government can "deliver the people's priorities over the next three years"[56]. Polling by Public First found that medical research was by far the most popular discipline for R&D investment with the public, with 57% of respondents ranking it among their top three priorities.[57]

18. Medical research also offers excellent return on investment – every £1 of public investment in medical research delivers a return equivalent to around 25p every year, forever[58] – and a range of benefits to the wider economy (**see box 2**). This is alongside the economic benefits of improved health outcomes, such as potentially reduced healthcare costs, efficiencies in healthcare delivery, reduced disparities and a healthier workforce.[59]

19. Public investment can play a particularly important leveraging role in medical research: by de-risking, simplifying or stimulating research in areas where there are potentially large health benefits, but where market-size, upfront costs or complexity can initially deter private investors from financing projects.[60] The UK Biobank is just one example of how long-term public investment in medical research lays necessary foundations for private investment (**see case study 2**).

20. Investing now is crucial in order to realise the benefits of medical research in the future – not least in the face of possible future crises. Between the expertise of academia, the infrastructure of the NHS and the experience and investment of industry, the UK was able to respond quickly to COVID-19. As Professor Dame Anna Dominiczak DBE FRSE FMedSci notes:

> *"We must continue to invest in the fundamentals, so in future we can again respond from a place of strength."*

21. The '100 days mission' report to G7 by the pandemic preparedness partnership sets out a similar case for sustained investment in long term clinical trials capability, vaccine development and manufacturing to ensure the UK and the wider global community is prepared for future pandemic threats.[61]

22. The following sections set out specific ways in which the Government should invest in the fundamentals of UK medical research to drive continued improvements in health and wealth.

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[56] Chancellor launches vision for future public spending - GOV.UK (www.gov.uk)
[57] Advocating for R&D Investment (wellcome.org)
[58] Wellcome Trust (2017) National Institute for Health Research, Academy of Medical Sciences, Medical Research Council, Arthritis UK Medical research: What's it worth?
[59] Harnessing technology for the long-term sustainability of the UK's healthcare system: report - GOV.UK (www.gov.uk)
[60] The relationship between public and private R&D funding (publishing.service.gov.uk) and The case for public support of Innovation (publishing.service.gov.uk)
[61] 100 Days Mission to respond to future pandemic threats (publishing.service.gov.uk)

Box 1 – Medical research and health

The COVID-19 pandemic has been a prominent example of the importance of medical research to the health of the UK population: from diagnostics to treatments (**see case study 3**) to vaccines.

Before the pandemic, UK medical research has been improving the health of the public in many ways through advances in patient care. For example:

1990s

Practice-changing clinical trials in radiotherapy and imaging

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 National Institute for Clinical Excellence (NICE) and international guidelines and helping set standard care in the UK. Patients all over the world are benefiting from these changes in clinical practice.[62]

2000s

Brain cooling treatment for newborns starved of oxygen

Imperial College London researchers pioneered the implementation of a brain cooling treatment to improve the survival of newborns starved of oxygen during birth.[63,64,65] It is now recommended by NICE guidelines and is the standard of care in most resource-rich and -intermediate countries.

2010s

Nurse staffing numbers in hospitals

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.[66,67,68] 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.[69]

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.[70,71] 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.[72,73,74] Children at Great Ormond Street Hospital and adults at UCLH have been the first in Europe to receive this ground-breaking treatment.[75]

[62] https://www.icr.ac.uk/about-us/our-achievements/our-scientific-discoveries/practice-changing-clinical-trials-in-radiotherapy-and-imaging
[63] https://www.imperial.ac.uk/media/imperial-college/medicine/dept-medicine/Cooling-Babies-Limits-Brain-Injury.pdf
[64] https://www.imperial.ac.uk/department-of-medicine/research/impact/increasing-the-survival-rate-of-oxygen-starved-babies/
[65] https://www.nice.org.uk/guidance/ipg347/chapter/2-The-procedure
[66] http://www.rn4cast.eu/about1.html
[67] https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(13)62631-8/fulltext
[68] https://www.bmj.com/content/344/bmj.e1717
[69] https://www.rcn.org.uk/professional-development/publications/pub-003860
[70] https://www.cancer.gov/publications/dictionaries/cancer-terms/def/car-t-cell-therapy
[71] https://www.england.nhs.uk/cancer/cdf/car-t-therapy/
[72] https://www.england.nhs.uk/cancer/cdf/car-t-therapy/
[73] https://www.england.nhs.uk/2018/11/first-children-with-cancer-to-begin-treatment-with-revolutionary-car-t-therapy/
[74] https://www.longtermplan.nhs.uk/wp-content/uploads/2019/01/nhs-long-term-plan.pdf
[75] https://www.gosh.nhs.uk/news/gosh-patient-first-receive-ground-breaking-new-cancer-therapy-nhs

Box 2 – Medical research and the economy

- Every £1 of public investment in medical research delivers a return equivalent to around 25p every year, forever.[76]
- Currently, the UK life sciences industry employs over 256,000 people and generates a turnover of £80.7bn.[77]
- In 2019, the pharmaceuticals sector performed £4.8bn worth of R&D – more than any other sector – and was the largest employer of people in R&D related roles (29,000).[78]
- The Biomedical Catalyst (set up by the Medical Research Council and Innovate UK) tests and develops innovative technologies for healthcare. Evaluations show that each public £1 invested by the catalyst in late stage, industry-led research and development generated £4.70 in wider economic benefits[79]
- Between 2016/17 and 2018/19, research activity funded by the NIHR Clinical Research Network has generated[80]:
    - £8 billion in Gross Value Added
    - An average revenue of £9,189 per patient for NHS Trusts England from life sciences companies
    - A pharmaceutical cost saving of between £4,143 and £7,483 per patient

[76] Wellcome Trust (2017) National Institute for Health Research, Academy of Medical Sciences, Medical Research Council, Arthritis UK Medical research: What's it worth?
[77] Bioscience and Health Technology Sector Analysis 2019 (publishing.service.gov.uk)
[78] Research & Development spending (parliament.uk)
[79] UKRI-200721-AnnualReport2020-2021.pdf
[80] https://www.nihr.ac.uk/documents/partners-and-industry/NIHR_Impact_and_Value_report_ACCESSIBLE_VERSION.pdf

UK Research and Innovation

23. Increasing public investment in R&D must include increased support for UKRI and, in particular, the dual support model for R&D in Higher Education Institutions (HEIs), including both the budget for the research councils and quality-related research funding (QR).

24. The Academy welcomed the Government's commitment at the 2020 spending review to increase investment in core UKRI and National Academy funded research by more than £1 billion by 2023-2024.[81,82]

25. It is crucial that this specific commitment is delivered as part of a broader, long-term effort to ensure all parts of the science budget increase in a balanced way, in real terms. This must include the Research Councils and the vital discovery research they fund, upon which much of the rest of the UK's RDI system depends. As the Government's R&D Roadmap notes:

> *"…we accept the need to reverse the decline in funding for the long-term, fundamental research on which the entire system depends"*[83]

> *"…our investment level is relatively low, with problems emerging in the system. Through increased investment we see a major opportunity to build on our successes while tackling these problems"*[84]

26. Specifically, the budget of the Medical Research Council (MRC) – which funds essential basic research, prototype discovery and design, and preclinical development work – must continue to be uplifted in line with the rest of the science budget. The RECOVERY trial (**see case study 3**) and the UK Biobank (**see case study 2**) are just two examples of the life-saving work made possible by funding through the MRC.

27. This Spending Review must ensure that **research council budgets receive a long overdue, real-terms, multi-year uplift** so that they can plan ahead with certainty, continue to support response-mode funding and nurture the talent that will be critical to developing both the ideas and talented individuals who will be the foundation for our future success in R&D.

Recommendation: **Commit to providing long-term, real-terms increases to the core research budgets of the seven research councils.**

28. The UK's research strength is built on the foundations of a world class university sector, with four of the world's top 20 universities based in the UK, including 5 of the top 20 universities for clinical and health research.[85] Research in universities is critical for the development of new ideas and knowledge that will improve people's

[81] Spending Review 2020 - GOV.UK (www.gov.uk)
[82] President's response to Spending Review | The Academy of Medical Sciences (acmedsci.ac.uk)
[83] UK Research and Development Roadmap (publishing.service.gov.uk)
[84] UK Research and Development Roadmap (publishing.service.gov.uk)
[85] World University Rankings 2022 by subject: clinical and health | Times Higher Education (THE)

health and drive innovation, creating a highly skilled research workforce and incentivising private investment in the UK (**see case study 1**).

29. Meanwhile, in large part thanks to research in our university sector, the UK has a global reputation for research. The UK has the highest per-capita share of the top 1% most frequently cited life sciences publications worldwide, second only to the US in terms of gross share.[86]

30. Another exceptional feature of our university system is the link with the NHS which – though it must be improved (see section 4) – has already helped create the strongest clinical trials pipeline in Europe.[87]

31. However, research soon to be published by the Russell Group shows that quality-related (QR) funding, the second branch of the UK's dual support system, saw a 17% fall in its value in real terms since 2010. Research in universities is currently funded at roughly 71% of the full cost of performing the research.[88] QR funding plays a critical role in empowering universities to make strategic decisions about investing in talent and infrastructure.[89] **Increasing the level of support through this fund will be vital to securing the long-term sustainability of research in HEIs.**

32. **Sustainable support for universities through QR will allow the UK to grow the scientists and leaders of the future**, for both the private and public sectors, and translate their work into public benefit in the form of health and economic outcomes. **Without securing the pipelines of skilled scientists and innovators and world-class research, our ambitions to become a science and tech superpower will fail**.

Recommendation: **Reverse the real-terms decline in QR funding, to ensure that research in the UK's world-class university sector continues to drive innovation.**

[86] uuk-he-vision.pdf (universitiesuk.ac.uk)
[87] uuk-he-vision.pdf (universitiesuk.ac.uk)
[88] Regional-policy-and-RD_HEPI-Report-137-FINAL.pdf
[89] https://wellcome.org/sites/default/files/empowering-uk-universities-how-strategic-institutional-support-helps-research-thrive.pdf

National Institute for Health Research

33. In England, the National Institute for Health Research (NIHR) plays a critical role in investing in clinical research infrastructure, for example through Biomedical Research Centres (BRCs) and the Clinical Research Network (CRN).[90]

34. The work of the NIHR has been pivotal in the UK's response to COVID-19 – enabling the development of treatments and vaccines, as well as engaging the public in research across all four UK nations (**see box 3 and case studies 2 and 3**). Chief Medical Officer, Professor Chris Whitty FMedSci, highlighted the NIHR CRN as one of the "precursor activities" and "pre-existing systems" which allowed the UK to respond as quickly to the COVID-19 pandemic as it did – enabling clinical trials for vaccines to be conducted at multiple sites very quickly.[91]

35. More broadly, economic analysis has demonstrated that between 2016/17 and 2018/19, research supported by the NIHR CRN generated an estimated £8bn of gross value added (GVA), 47,467 full time equivalent (FTE) jobs, average revenue of £9,189 per patient for NHS Trusts England from life sciences companies and a pharmaceutical cost saving of £4,143–7,483 per patient.[92]

36. In one case, funding from the NIHR's Invention for Innovation (i4i) programme supported a company called Creo Medical to pioneer a less invasive and safer method for treating gastric carcinoma.[93] Their device has enabled NHS savings of around £5,000 per procedure, as well as roughly £111 million per year in shorter hospital stays, while the company has raised at least £68 million in total and employs 50 people in development and manufacturing.[94]

37. In addition, in 2018/19, every single NHS Trust in England took part in research, with over 1 million clinical research participants, demonstrating the key link between health research and the health of patients in all parts of the country.[95] NHS Trusts in Leicester and Hartlepool were among the top recruiters to the RECOVERY trial (**see case study 3**).[96,97]

38. Ensuring the budget of the NIHR is uplifted in line with the rest of the science budget – in real terms, over a number of years – will be crucial for maintaining balance within the UK's RDI system and for delivering on the Government's priorities of ensuring strong and innovative public services, as well as levelling up across the UK.

Recommendation: **Uplift the NIHR budget – in real terms, over the long-term – in line with other parts of the science budget.**

[90] https://assets-global.website-files.com/5da42e2cae7ebd3f8bde353c/5dda924905da587992a064ba_Conservative%202019%20Manifesto.pdf
[91] https://committees.parliament.uk/oralevidence/1376/pdf/
[92] https://www.nihr.ac.uk/documents/partners-and-industry/NIHR_Impact_and_Value_report_ACCESSIBLE_VERSION.pdf
[93] UK Research and Development Roadmap (publishing.service.gov.uk)
[94] UK Research and Development Roadmap (publishing.service.gov.uk)
[95] News: Record number of patients take part in clinical research | NIHR
[96] Leicester's hospitals recruit over 1,000 patients for the RECOVERY trial — RECOVERY Trial
[97] North Cumbria is a top recruiter in COVID-19 treatment trial :: North Cumbria Integrated Care (ncic.nhs.uk)

Box 3 – NIHR and the UK's response to COVID-19

- The NIHR Clinical Research Network (CRN) – developed before the pandemic through Government investment – enabled clinical trials for COVID-19 vaccines to be conducted at multiple sites very quickly, facilitating the UK's rapid response.[98]
- The NIHR invested to co-found, with the Medical Research Council, the RECOVERY trial (**see case study 3**) and its work to identify treatments for COVID-19 patients – just one of which is estimated to have saved 1 million lives worldwide, including 22,000 lives in the UK, as well as many millions of pounds in avoided costs of alternative treatments.[99,100]
- As of March 2021, more than one million members of the public – across England, Northern Ireland, Scotland and Wales – have taken part in COVID-19 research. This is across 180 studies, over 100 of which were funded by the NIHR, amounting to more than £108 million of investment.[101]
- The NIHR is one of a number of several key funders of the UK Biobank, a world-leading database of genetic and health information which has enabled vital COVID-19 research and, since its creation, has leveraged private funding worth over five times the amount of Government and other non-private funding it has received (**see case study 2**).

[98] https://committees.parliament.uk/oralevidence/1376/pdf/
[99] NHS England » COVID treatment developed in the NHS saves a million lives
[100] RECOVERY trial: The potential health and economic impact of dexamethasone treatment for patients with COVID-19 - HDR UK
[101] News: UK COVID-19 research passes one million participants | NIHR

Case study 3 – RECOVERY Trial

The RECOVERY trial is the world's largest clinical trial into treatments for COVID-19, with more than 40,000 participants across nearly 200 hospitals in the UK.[102] It was set up in the UK at record speed – drawing on the expertise of UK academia – and deployed in all parts of the country with consistency and pace – using the infrastructure and workforce of the NHS.

The trial has been invaluable in identifying treatments that do and don't work against COVID-19. Results have been published for 9 different treatments so far, including Dexamethasone, which is estimated to have saved 22,000 lives in the UK, and around 1 million worldwide since its discovery as an effective COVID-19 treatment.[103,104]

The success of the RECOVERY trial is a lesson in the importance of investing ahead of crises in – to echo the Government's clinical research strategy – "the people, processes and systems needed to deliver high quality health research".[105] The trial was a huge collaborative effort across clinical and research communities, involving 177 hospitals and as many as 3,500 highly skilled doctors, nurses and research staff.[106,107] It demonstrated the importance of valuing every single role in a research team, all of which proved necessary for delivering at the scale, pace and quality that was seen.

The trial also made use of the National Institute for Health Research Clinical Research Network (NIHR CRN) and was itself reliant on an initial joint investment of £2.1 million from the NIHR (see section 3c) and the Medical Research Council (MRC; see section 3b).[108]

RECOVERY illustrates the important relationship between clinical research and improved care, and how enhancing research in the NHS can help improve clinical outcomes (see section 4). Moreover, it exemplifies how research in the NHS is a truly national asset that is uniquely capable of including, reflecting the needs of, and ultimately benefitting patients in every part of the country. For example, NHS Trusts in Leicester and Hartlepool were among the top recruiters to the trial.[109,110] (See section 4 for the recommendation to fund an NHS research pilot).

"Past investment in the UK's clinical research capacity – including through the NIHR CRN – made the RECOVERY trial possible. Now we must support the NHS to continue to make clinical research part of its day job, an instrumental part of improving outcomes, not just something off to the side." – Professor Sir Martin Landray FMedSci

[102] https://www.ukri.org/our-work/tackling-the-impact-of-covid-19/vaccines-and-treatments/recovery-trial-identifies-covid-19-treatments/
[103] The Recovery Collaborative Group (2021). *Dexamethasone in Hospitalized Patients with Covid-19.* New England Journal of Medicine **384**, 693-704
[104] NHS England (2021). *COVID treatment developed in the NHS saves a million lives.* https://www.england.nhs.uk/2021/03/covid-treatment-developed-in-the-nhs-saves-a-million-lives
[105] Saving and Improving Lives: The Future of UK Clinical Research Delivery - GOV.UK (www.gov.uk)
[106] Saving and Improving Lives: The Future of UK Clinical Research Delivery - GOV.UK (www.gov.uk)
[107] Wise J & Coombes R (2020). *Covid-19: The inside story of the RECOVERY trial.* BMJ **370**, m2670
[108] https://webarchive.nationalarchives.gov.uk/ukgwa/20201012093557/https:/mrc.ukri.org/news/browse/covid-19-vaccine-therapy-research-boosted-by-six-new-projects-in-rapid-response/
[109] Leicester's hospitals recruit over 1,000 patients for the RECOVERY trial — RECOVERY Trial
[110] North Cumbria is a top recruiter in COVID-19 treatment trial :: North Cumbria Integrated Care (ncic.nhs.uk)

The Academy of Medical Sciences

Medical research charities

39. Medical research charities play a unique role in the UK's research funding ecosystem, providing £14.5 billion of funding since 2011 and leveraging a further £2.7 billion.[111,112] In 2019, members of the Association of Medical Research Charities (AMRC) provided stipends for more than 1,700 PhD students as part of their wider support for the salaries of over 17,000 researchers.[113]

40. Research charities often invest in early-stage, high-risk research which may not initially attract private investors, thereby complementing public investment and helping to leverage private investment. Without our charities, the UK's research landscape would be far less developed than it currently is (**see box 4**).

Box 4 – Unique role of medical research charities

When Government, UKRI and charitable funding are compared, members of the Association of Medical Research Charities (AMRC) provide:[114]

- 20% of funding into disease prevention research
- Over 25% of funding into mental health research
- 26% of funding into health research infrastructure
- 50% of funding into the development of treatments and therapies
- 66% of investment into cancer and cardiovascular research

41. Charities also provide a vital link to patient and carer communities across the UK: 83% of AMRC charities use patient voice in their research, strategy or influencing work.[115] Studies suggest that research involving the public is generally of higher quality, furthering the importance and relevance of charitable research to patients.[116]

42. Charities demonstrate how RDI can help level up across the UK, to increase and spread opportunity. In 2019, almost half of charity funding was spent on research outside of London and the South East.[117]

43. However, the pandemic has significantly undermined the ability of medical research charities to play their much-needed part. Charity research funding has dropped by £270 million since the pandemic started, with 32% of AMRC charities having had to cancel or delay new research projects that are crucial to developing new treatments.[118] One in two AMRC charities plan to cut their research spend over the next year, by an average of 37%, while 56% of AMRC charities will have to cancel or delay funding for early career researchers and skilled research roles.[119]

44. It is crucial that Government work in partnership with the UK's medical research charities to ensure they are able to sustainably play their unique and vital role in the

[111] Our sector's footprint | Association of Medical Research Charities (amrc.org.uk)
[112] 4) Stimulating further research via new funding or partnerships | Association of Medical Research Charities (amrc.org.uk)
[113] Association of Medical Research Charities (2020) COVID-19: The risk to charity-funded researchers, https://www.amrc.org.uk/covid-19-the-risk-to-charity-funded-researchers
[114] UK-Health-Research-Analysis-2018-for-web-v1-28Jan2020.pdf (hrcsonline.net) and Without Charities | Association of Medical Research Charities (amrc.org.uk)
[115] https://committees.parliament.uk/publications/5426/documents/54219/default/
[116] Briefing notes for researchers - public involvement in NHS, health and social care research (nihr.ac.uk)
[117] https://committees.parliament.uk/publications/5426/documents/54219/default/
[118] https://committees.parliament.uk/publications/5936/documents/67546/default/
[119] https://committees.parliament.uk/publications/5936/documents/67546/default/

UK's research ecosystem going forwards. This includes though the charity element of QR funding, the charity research support fund (CRSF). As noted in the Government's support package for eligible universities in 2020:

> *"Charity-funded research has been a distinctive feature of the UK research system and a successful partnership with government through the charity element of QR. Now is the time to align that partnership as a more sustainable element of the research system"*[120]

45. The CRSF plays an extremely important role in the sustainability of charitable research funding, by covering some of the indirect costs associated with research. In 2018/19 the CRSF received a small uplift of 3%, however prior to this the fund had been fixed for 8 years. In this time, the relative value of the fund was eroded by both inflation and an increase in charitable funding for medical research, from around £1 billion in 2010 to over £1.6 billion in 2017.[121]

46. It is important recognise the vital role of charitable investment in research in UK universities and ensure that the Charity Research Support Fund continues to be financed appropriately.

Recommendation: **Work with the UK's medical research charities to ensure they can continue to play a unique and vital role in the research ecosystem, including by bolstering the CRSF.**

[120] Sustaining University Research Expertise (SURE) package - GOV.UK (www.gov.uk)
[121] Key stats | Association of Medical Research Charities (amrc.org.uk)

Invest in NHS research and development

47. The COVID-19 pandemic has clearly demonstrated the value and necessity of clinical research, as well as the benefits of collaboration between academia, industry and the NHS in developing lifesaving therapeutics and improving patient care.

48. The NHS-delivered RECOVERY trial (**see case study 3**) identified dexamethasone as the first effective treatment for patients suffering severe COVID-19 – estimated as of March 2021 to have saved 1 million lives worldwide, including 22,000 lives in the UK, as well as many millions of pounds in avoided costs of alternative treatments.[122,123] The development of the Oxford/AstraZeneca vaccine is another major example of the power of clinical research and cross-sector collaboration.

49. Before and beyond COVID-19, research in the NHS has an essential role in driving health outcomes for patients across the country, from significant advances in cancer treatment to improvements in the delivery of hospital care (**see box 1**).

50. The Academy welcomes the Government's ambitious vision for clinical research delivery (March 2021) and Life Sciences Vision (July 2021), which between them showcase the UK's tremendous success in clinical research and set out a clear direction to build on our strengths and design an even stronger and more resilient system. A key part of this will be meeting the urgent need to support the recovery of halted research and the careers of the many clinical researchers and other clinical trials unit (CTU) staff in the UK who have been impacted.

51. Recent analysis shows the number of commercial clinical trials initiated in the UK continues to decline.[124] In 2017, 667 commercial clinical trials were initiated and in 2020, 508 were initiated, representing a decrease of 24%. Excluding COVID-19 studies, the total in 2020 is 440, representing a decrease of 34% from 2017.[125]

52. At the same time, future UK success in clinical research will require maintaining and investing in the kind of collaboration we have seen throughout the pandemic between the NHS, academia and industry. In our report on "Transforming health through innovation: Integrating the NHS and academia", we make a series of recommendations to enhancing the NHS-academia interface and better harness the research expertise and capability of the NHS to improve the health and wealth of the nation.[126]

53. One of these recommendations is to establish a pilot programme under which a proportion of consultants working in the NHS are offered a contract that includes dedicated time for research. This could help to spread the benefits of research-active clinicians and improve our understanding of how protected time for research enhances these benefits.

[122] NHS England » COVID treatment developed in the NHS saves a million lives
[123] RECOVERY trial: The potential health and economic impact of dexamethasone treatment for patients with COVID-19 - HDR UK
[124] abpi_clinical-trials-report-2021-final.pdf
[125] abpi_clinical-trials-report-2021-final.pdf
[126] https://acmedsci.ac.uk/policy/policy-projects/nhs-academia-interface

Recommendation: **Fund an NHS research pilot where a proportion of consultants working in the NHS are offered a contract that includes dedicated time for research (estimated costs below).**

54. This pilot can provide comprehensive evidence on the impact of protected time for research on a range of factors – including research activity, staff recruitment and retention, and patient outcomes. Ultimately, we hope that this will provide the evidence base for a longer-term approach to protected time for research for the health and social care workforce.

55. We recommend the pilot should take place in a mixture of large teaching NHS Trusts or Health Boards and district general hospitals across the UK, as another way to help ensure research is reflecting the needs of, and benefitting, the public in every part of the country.

56. We estimate that the costs of conducting such a pilot using one scenario[127], would be between £21.7 million and £25 million per year. However, over time, we anticipate that the pilot would be cost-neutral or even cost-saving by improving recruitment and retention, reducing expenditure on locums, and increasing research funding from life sciences companies. This is without considering the costs saved overall by improved health outcomes.

57. **In support of the pilot itself, there is a growing body of evidence** outlining the benefits of clinical research to patients, as well as to the NHS workforce (**see box 5**).

Box 5 – Evidence in support of an NHS research pilot

- Research active healthcare settings deliver better care, as reflected by the higher Care Quality Commission (CQC) ratings they receive.[128]
- Research active hospitals also have better patient outcomes, including lower mortality rates, with the benefits of research extending beyond those directly participating in research.[129,130,131]
- Evidence suggests that engaging in research may improve clinicians' job satisfaction, can boost morale and can reduce burnout.[132,133,134,135,136] Almost two thirds (64%) of doctors surveyed by the Royal College of Physicians (RCP) said they would like to spend more time on research.

[127] We have estimated the cost of a scenario in which 20% of consultants have 20% of their time protected for research in ten NHS Trusts (five teaching NHS Trusts or Health Boards and five district general hospitals) across the UK. https://acmedsci.ac.uk/file-download/68338531
[128] Jonker L & Fisher SJ (2018). *The correlation between National Health Service trusts' clinical trial activity and both mortality rates and care quality commission ratings: a retrospective cross-sectional study*. Public Health 187,1-6. https://www.sciencedirect.com/science/article/pii/S0033350618300015
[129] Ozdemir BA, *et al.* (2015). *Research Activity and the Association with Mortality*. PLoS One 10, e0118253.
[130] Boaz A, *et al.* (2015). *Does the engagement of clinicians and organisations in research improve healthcare performance: a three-stage review.* BMJ Open 5, e009415.
[131] McManus RJ, *et al.* (2008). *How representative of primary care are research active practices? Cross-sectional survey*. Family Practice 25, 56–62.
[132] Lambert TW, Smith F, Goldacre MJ. *Making clinical academic careers more attractive: views from questionnaire surveys of senior UK doctors.* JRSM Open. 6(8): 2054270415602644, 2015.
[133] Dale J, Potter R, Owen K, Parsons N, Realpe A, Leach J. *Retaining the general practitioner workforce in England: what matters to GPs? A cross-sectional study.* BMC Family Prcatice. 16:140, 2015.
[134] Watson C, King A, Mitra S, Shaaban AF, Goldstein AM, Morowitz MJ, Warner BW, Crombleholme TM, Keswani SG. *What does it take to be a successful pediatric surgeon-scientist?* Journal of Pediatric Surgery. 50(6): 1049-52, 2015.
[135] Community Research (2018). *Adapting, Coping, Compromising research.* https://www.gmc-uk.org/-/media/documents/adapting-coping-compromising-research-report-79702793.pdf
[136] Shanafelt TD, et al. (2009). Career Fit and Burnout Among Academic Faculty. Archives of Internal Medicine 169(10), 990–995.

- Including academic content in medical posts has also been shown to enhance recruitment and retention, with some doctors using research as a mechanism to avoid burnout.[137,138,139]
- Research-focused roles are likely to lead to more applications, with over two thirds (67%) of respondents to an RCP survey stating that having dedicated time for research would make them more likely to apply for a role.

58. Offering research opportunities would be an effective way of attracting staff and increasing job satisfaction, while contributing to the overall improvement in patient outcomes and healthcare delivery. This could help to relieve pressures of high staff turnover, reliance on locums, and identifying cost effective innovations to improve care.[140] These points are particularly pertinent given the increased risk and prominence of 'burnout' within the NHS workforce in relation to COVID-19.[141]

59. All the potential benefits of increased time for research in the NHS rest upon the presence of a sufficient clinical academic workforce. In our report on "Transforming health through innovation: Integrating the NHS and academia", we note that there is a decline in the number of clinical academics, who operate at the interface between academia and the NHS and lead research.[142] In 2017, clinical academics represented only 4.2% of NHS medical consultants (down from 7.5% in 2004), 0.4% of general practitioners (GPs) and less than 0.1% of the nursing, midwifery and allied health professions.[143] Only 42% of GP practices are research active.[144]

60. **Without investment, particularly in the future generation of scientific leaders, the clinical academic workforce may continue to shrink, jeopardising the value that NHS research delivers to patients and the public across the UK, now and in the future.** Ensuring stable career pathways for early career researchers will help secure the leaders and innovators of the future and limit the number of researchers whose careers are stalled or even stopped by COVID-19.

[137] Rees MR, Bracewell M, On behalf of Medical Academic Staff Committee of the British Medical Association (2019*). Academic factors in medical recruitment: evidence to support improvements in medical recruitment and retention by improving the academic content in medical posts.* Postgraduate Medical Journal 95, 323-327
[138] Community Research (2018). *Adapting, Coping, Compromising research.* https://www.gmc-uk. org/-/media/documents/adapting-coping-compromising-research-report-79702793.pdf
[139] Shanafelt TD, et al. (2009). *Career Fit and Burnout Among Academic Faculty.* Archives of Internal Medicine 169(10), 990–995.
[140] Rees MR, Bracewell M, On behalf of Medical Academic Staff Committee of the British Medical Association (2019*). Academic factors in medical recruitment: evidence to support improvements in medical recruitment and retention by improving the academic content in medical posts.* Postgraduate Medical Journal 95, 323-327
[141] 66744378 (acmedsci.ac.uk)
[142] Box three in our associated summary of case studies, found at the following address: www. acmedsci.ac.uk/nhs-academia-interface/case-studies.
[143] Council of Deans of Health (2018). Nursing, midwifery and allied health clinical academic research careers in the UK. https://councilofdeans.org.uk/wp-content/uploads/2018/08/Nursing-midwiferyand-allied-health-clinical-academic-research-careers-in-the-UK.pdf
[144] Royal College of General Practitioners (n.d.). Clinical Research for GP Practices. https://www.rcgp. org.uk/clinical-and-research/about/clinical-news/2018/june/clinical-research-for-gp-practices.aspx

A cross-Government approach

61. Further to funding commitments outlined above, we welcome the Government's commitments place science and technology at the heart of Government through the establishment of a new National Science and Technology Council supported by the Office for Science and Technology Strategy.

62. These new structures could play an important role in supporting cross-Governmental coordination on many issues relating to science and technology. This is particularly critical in health-related research which spans multiple Departments.

63. Ultimately the activities and decisions of these bodies should be underpinned by data. This data will come from a range of sources, including that generated through response-mode funding (as outlined above), as well as Public Sector Research Establishments (PSREs) and Non-ministerial government departments (NMGDs), such as the UK Statistics Authority, which oversees its Executive Agency, the Office for National Statistics (ONS).

64. The Office for National Statistics (ONS) has played a critical role in our understanding of the COVID-19 pandemic, including providing invaluable information on health outcomes. This health data has not only been important for decision-making but is also a hugely powerful research dataset.

65. Investing in these Government capabilities in addition to response-mode funding should be an important part of the Government's investment strategy.

66. A cross-Government approach will also be crucial for tackling climate change and maximising the health co-benefits of the transition to Net Zero – as discussed in an upcoming joint Academy report on climate change and health with the Royal Society.[145] This report will aim to quantify the near-term health co-benefits of net zero policies in the UK, providing a high-level synthesis across various sectors, including healthcare, energy, mobility, built environment, and employment.

[145] https://acmedsci.ac.uk/policy/policy-projects/climate-change-and-health

Unlock medical research in business

67. Public investment is uniquely important for leveraging private investment in the field of medical research (**see section 3 and case study 1**). The significance of this role is considerable, as Government funding underpins investment from, among others, the pharmaceutical sector, which has consistently the biggest investor in UK R&D – of all kinds – over the last decade.[146]

68. To make the most of this leveraging role and help increase private sector investment in R&D on the road to 3%, this spending review should set out measures to encourage and support businesses to invest in R&D and for innovative SMEs to scale and grow: particularly to move beyond the pattern of UK SME companies working towards acquisition or collapse.

69. The Academy has previously welcomed important components of the RDI pipeline such as the Catapult network. Measures at this Spending Review could include: renewing investment in highly valued schemes such as the Biomedical Catalyst; enhancing R&D tax credits; and unlocking pension funds to invest in innovative early-stage life sciences firms.

Recommendations: **Renew investment in the Biomedical Catalyst, enhance R&D tax credits and unlock pension funds to invest in innovative early-stage life sciences firms.**

[146] 32939336 (acmedsci.ac.uk)

Invest in medical research to level up across the UK

70. Medical research is intertwined with the health and wealth of every part of the UK. In 2018/19, every single NHS Trust in England took part in research, reflecting and ultimately improving the health of patients in all parts of the country.[147] More broadly, research improves health outcomes for patients and the public across the UK (**see box 1**). And as noted in the Queen's Speech 2021:

> *"Life Science jobs are spread the length and breadth of the UK, making the Life Sciences industry an important driver for levelling up economic opportunity right across the country."*[148]

71. Cross UKRI schemes such as the Strength in Places Fund (SiPF) have begun to prove their value in supporting interdisciplinary research, driving collaboration between public and private sectors and promoting research across the country. Further opportunities to expand and streamline these schemes should be taken.

72. Government must ensure that its efforts to level up the whole country take account and make most use of the powerful social and economic driver that is R&D. This includes the planned UK Shared Prosperity Fund (UKSPF) and any other potentially relevant initiatives such as the Levelling Up Fund.

Recommendation: **Ensure the UKSPF and any other similar initiatives can support research and innovation across the UK to promote regional growth.**

73. Any support for R&D as part of levelling up must provide adequate support for regional investment in R&D activities, enabling collaboration within and between regions. Regional strengths – which often manifest as co-location clusters or regional clustering of academia, the NHS and industry bodies – are a potential priority for supporting R&D across the UK.[149] Life sciences clusters can offer tangible economic benefits, helping companies to maximise their innovative potential as well as supporting R&D in their regions and helping to set regional priorities. [150,151]

74. The UK has enormous strength in research across the country. The ambition and commitments in the R&D Roadmap provide the opportunity to build on this excellence to drive up the R&D intensity; create highly skilled jobs; and spread the benefits of R&D investment more equitably across the country. In doing so, the focus must remain on supporting existing and emerging excellence. This means working with local, regional and national partners to identify strengths. Critically, levelling-up must not be at the expense of regions with existing globally important research institutions.

[147] News: Record number of patients take part in clinical research | NIHR
[148] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/986770/Queen_s_Speech_2021_-_Background_Briefing_Notes..pdf
[149] 31821958 (acmedsci.ac.uk)
[150] UK life sciences strategy - GOV.UK (www.gov.uk)
[151] 31821958 (acmedsci.ac.uk)

Invest in collaborations and access

75. The Government's integrated review of security, defence, development and foreign policy rightly highlights science and technology as areas that will help define the UK's role in the global community.[152] Around 57% of UK research outputs are produced in collaboration with an international co-author and 50% of all research-only staff and 35% of postgraduate research students working in our universities are from outside the UK.[153]

76. The Academy welcomes the emphasis on international partnerships as an essential component of the Government's own-collaborate-access framework, and strongly supports the UK's participation in Horizon Europe, the world's largest collaborative funding programme for research and innovation.

77. The confirmation of funding to cover the UK's participation fee for Horizon Europe in 2021/22 was very positive news.[154] A long-term solution must now be found which does not undermine existing or planned commitments to UK R&D. Offering a clear, multi-year commitment to cover the costs of Horizon Europe, without reducing other parts of the science budget, will give the scientific community both certainty and confidence in the Government's commitment to cementing the UK as a leading destination for conducting world-class research and collaborations (**see case study 1 for how this relates to the UK's appeal to investors**).

Recommendation: **Commit to covering the cost of UK participation in Horizon Europe without cutting the existing science budget.**

78. Of course, the UK's scientific collaborations reach not just across, but also beyond, Europe. The UK has been a trusted and valued scientific partner around the globe for many years, building international partnerships, driving improvements in health, enhancing the UK's reputation as a destination for world-class research and boosting our attractiveness to global talent and investment.

79. The Prime Minister rightly notes in his foreword to the Integrated Review that the UK has a "global network of friends and partners…with the opportunity to forge new and deeper relationships".[155] In order to maintain this network, make the most of new opportunities and successfully face global challenges like climate change and its associated health impacts, we must reinvest in our international scientific relationships, protecting and growing them as the valuable strategic assets they are.

80. Investing in international research not only enhances our global role, making the UK a partner of choice, but it delivers benefits to the UK through applicable research and

[152] Global Britain in a Competitive Age: the Integrated Review of Security, Defence, Development and Foreign Policy - GOV.UK (www.gov.uk)
[153] uuk-he-vision.pdf (universitiesuk.ac.uk)
[154] BEIS research and development (R&D) budget allocations 2021 to 2022 - GOV.UK (www.gov.uk), especially footnote 12
[155] Global Britain in a Competitive Age: the Integrated Review of Security, Defence, Development and Foreign Policy - GOV.UK (www.gov.uk)

greater resilience in the face of global health challenges such as Antimicrobial resistance and COVID-19.[156]

81. Unfortunately, the decision to temporarily reduce Official Development Assistance (ODA) from 0.7% to 0.5% GNI has already had a significant effect on UK-funded R&D abroad. The Academy of Medical Sciences no longer has funding to deliver our highly successful policy workshops with LMICs[157], threatening our ability to respond to the most critical international health issues. Terminating partnerships delivered with in-country partners who also commit money to the projects is likely to have impacted the reputation of the UK as a trusted partner, reduced the long-term capability of our partners and damaged the futures of young scientists. **Government must act now to mitigate this damage, by reinvesting in the UK's global RDI partnerships.**

82. Beyond the Academy, figures published by the Government suggest the cuts to ODA fall disproportionately on R&D. **Table 2** details how the ODA budget for BEIS received amongst the largest cuts, at 45%, compared to the overall drop in ODA funding at approximately 30%. One significant impact has been that the BEIS ODA allocation to UKRI has been cut by almost 50%, from £245 million to £125 million.[158]

Recommendation: **Reinvest in global RDI partnerships, providing funding and clarity as soon as possible to maintain the UK's relationships and reputation.**

83. It will also be important to ensure the UK retains and enhances its reputation as an attractive destination to conduct research or pursue a research career. **Our visa and immigration system must work for global researchers and their families.**

84. The development of the Global Talent Visa (GTV) was extremely welcome. The Academy looks forward to continuing to work with the Office for Talent and the rest of Government to ensure that the GTV offer keeps on improving. As the Government's R&D Roadmap notes:

> *"the visa system can still be seen as an obstacle with significant bureaucratic and cost barriers especially once family members are factored in…These cost barriers can be particularly stark for early career researchers and technical professionals"*[159]

85. Government should consider the overall cost of the visa system, which is significantly more expensive than other leading research nations (see Table 3).[160]

[156] https://www.newton-gcrf.org/impact/data-insights-blog/how-oda-funding-benefits-the-uks-higher-education-sector/
[157] https://acmedsci.ac.uk/policy/policy-projects/gcrf#:~:text=The%20Academy%20of%20Medical%20Sciences%27%20GCRF%20grant%20has%20supported%2021,address%20key%20global%20health%20challenges.
[158] https://www.ukri.org/our-work/ukri-oda-letter-11-march-2021/
[159] R&D People and Culture Strategy (publishing.service.gov.uk)
[160] https://acmedsci.ac.uk/file-download/36324703

Recommendation: **Assess the impact of the cost of the UK's visa offer on the movement of global research staff to the UK, especially in comparison to other leading research nations.**

Table 2: Departmental allocations of ODA 2016/17 to 2021/22 (£m)[161]

Department or cross-departmental fund	2016-17 (£m) *	2017-18 (£m) *	2018-19 (£m) *	2019-20 (£m) *	2020-21 (£m) **	2021/22 (£m) ***	Approximate % change (nearest 1%)
DFID	10,102	10,589	10,802	10,371		N/A	N/A
FCO	466	524	611	625		N/A	N/A
FCDO (FCO and DFID merged in 2020)	*(10,568)*	*(11,113)*	*(11,413)*	*(10,996)*	11,075	8115	-27%
BEIS	721	845	946	1,038	1,281	706	-45%
CSSF (excl. non-ODA)	484	549	624	625	644	337	-48%
Home Office	385	377	407	409	482	470	+14%
DHSC	99	168	234	289	273	207	-24%
DEFRA	75	78	80	81	95	92	-<1%
Prosperity Fund (excl. non-ODA)	55	73	120	290	237	-	
Other	173	182	203	183	54	58	+<1%
TOTAL					**14,141**	**9985**	**-29%**

Table 3: Upfront cost of obtaining a five-year UK Global Talent Visa (exceptional talent) compared with other leading science nations[162,163]

Country and visa category	Total cost to employee
Japan - Researcher Visa	£0
Spain - Residence Permit for Researchers	£64
S. Korea - E3 Research Visa	£99
Netherlands - Researcher	£145
Australia - Temp Activity Visa - Research (408)	£154
Australia - Research Student	£154
Sweden - Residence Permit for Visiting Researchers	£160
Germany - Scientific Visa for Researchers	£170
Italy - Research Permit	£207
US - J1 Research Scholar	£258
France - Talent Passport - Researcher	£313
India - Research Visa for all levels	£608
UK – Global Talent Visa	£2608

[161] Figures for 2016-17 to 2019-20 inclusive were taken from https://www.gov.uk/government/publications/uk-aid-tackling-global-challenges-in-the-national-interest/official-development-assistance-oda-allocation-by-department. Figures for 2020-21 were taken from Written statements - Written questions, answers and statements - UK Parliament. Figures for 2021-22 were taken from https://questions-statements.parliament.uk/written-statements/detail/2021-01-26/hcws735

[162] https://royalsociety.org/-/media/policy/Publications/2019/international-visa-systems-explainer-july-2019.pdf

[163] https://www.gov.uk/global-talent

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