University of Strathclyde Business School

The contribution of medical research funding by charities to the UK economy

Fraser of Allander Institute

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Disclaimer

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The report was commissioned in June 2021 by the British Heart Foundation.

The analysis was undertaken independently by the FAI. The FAI is committed to informing and encouraging public debate through the provision of the highest quality analytical advice and analysis. We are therefore happy to respond to requests for technical advice and analysis. Any technical errors or omissions are those of the FAI.

We are also thankful to the Association of Medical Research Charities (AMRC) and the UK Clinical Research Collaboration (UKCRC) for their help with this work.

Executive Summary

- Third sector medical research plays an important role both in the UK economy and in society.
- Medical research makes huge contributions to society through developing new treatments, improving existing ones and advancing technologies that can help save lives such as vaccines that help to fight against infectious diseases such as Covid-19.
- Charities are major funders of medical research in the UK. Medical research funding by charities has been estimated to be 14% of all health related research funding in the UK, providing £1.2bn in 2018.
- Without charity funding, the UK Government and public bodies would need to increase their direct funding[1] of health-related research by 85% to cover the shortfall.
- Our findings in the accompanying report show that whilst medical research has grown substantially since 2014, medical research funding by charities fell in 2020.
- Furthermore, whilst the primary aim of medical research funding by charities is to create benefits to people's health, the funding also makes a significant contribution to the UK economy:
  - Recipients of research funding purchase goods and services in order to undertake their research. This generates activity in their supply chains and across the whole of the UK economy.
  - R&D can boost output and productivity in an economy with new technologies, medicines and processes.
  - As new methods and technologies are discovered, there are knowledge spill-overs into the public, private and third sectors which boost productivity and economic growth.
- This report examines the first of these contributions and estimates the economic impact of medical research funding by charities on UK supply chains in terms of jobs, output and GVA (Gross Value Added).
- Our results estimate that in 2019, medical research funding by charities supported 51,350 jobs, £5.9bn in output and £3.5bn GVA in the UK.
- The pandemic had a significant impact on medical research funding by charities, placing jobs in research and the wider economy at risk. In 2020, the fall in medical research funding by charities put 3,900 jobs, £455m output and £265m GVA at risk in the UK.

1 Direct funding as a small amount of charity funding is originally sourced from the public sector.

- We also estimate multipliers for medical research funding by charities and compare these to 104 sectors of the UK economy. Every £1 million spent on medical research funding in the UK by charities supports:
  - £3.15 million of output – 31st highest multiplier out of 104 sectors.
  - £1.83 million of GVA – 5th highest multiplier out of 104 sectors.
  - 27 jobs – 14th highest multiplier out of 104 sectors.

UNITED KINGDOM
THIRD SECTOR MEDICAL RESEARCH

£5.9bn

Total output supported in the UK economy by third sector medical research expenditure

Third sector medical research supported a total of **51,350 FTE jobs** across the UK economy in 2019

Charity medical research spend has the **31st highest** output multiplier out of 104 UK sectors

Medical research spend by charities in the UK was **£1.8bn** in 2019

Charity medical research spend has the **14th highest** employment multiplier out of 104 UK sectors

Charity medical research spend has the **5th highest** GVA multiplier out of 104 UK sectors

In 2018, health-related research accounted for **25%** of all UK research and development, or **£8.64 billion**

Third sector medical research supported **£3.5bn** of GVA across the UK economy in 2019

[1]Source: UKCRC

1. Introduction

Medical research by charities is an important component of the UK economy. In addition to the obvious socio-economic benefits of medical research such as improved health outcomes and better health technologies, medical research also contributes positively to the UK economy.

The UK Government has prioritised research and development for several years, with research featuring prominently in the UK industrial strategy and the creation of the R&D roadmap in 2020.

The Covid-19 pandemic has also accelerated the role that R&D has to play in the UK economy. Science and innovation have played a crucial role in attempts to curtail the virus and provide treatment which have allowed the loosening of restrictions and the re-opening of the economy.

Medical research and development is seen as a key area of investment for the UK Government. In 2019, health related R&D accounted for 21% of government R&D expenditure in the UK, and the only area with greater investment was the advancement of knowledge in the economy[1]. This positions the UK well amongst its European counterparts, with only Denmark and Norway generating more medical research as a proportion of GDP. This report assesses the economic contribution and wider spill-over effects of medical research expenditure by charities to the UK economy.

The analysis focuses only on the economic impact of charity-funded medical research expenditure in the UK. It does not include the impact of capital expenditure, non-medical research and research undertaken in other countries.

We also refer to 2019 figures throughout this report due to the unprecedented effects of the Covid-19 pandemic on third sector medical research. This provides a more accurate representation of the economic contribution of medical research activities in the UK.

This report is divided into the following sections:

- Section 1 provides an overview of medical research by charities in the UK.
- Section 2 evaluates some of the socio-economic benefits provided by R&D and in particular, health R&D in the UK.
- Section 3 evaluates the economic contribution of third sector medical research expenditure in the UK in terms of economic output, gross value added (GVA) and jobs.

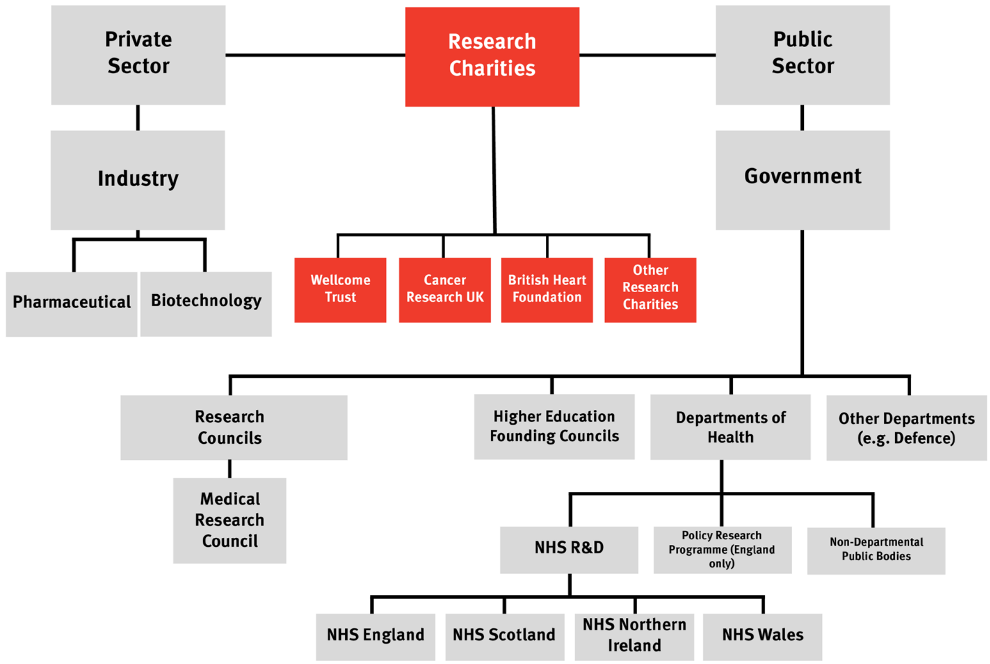
1 See UK Research and Development spending

2. Medical Research in the UK

Who undertakes medical research in the UK?

Medical research is an integral part of the UK economy and the UK benefits greatly from its reputation of world-leading research. In part, this reputation has been built on unique characteristics of UK's research environment including the health and social care system and the many well supported medical research charities.

Diagram 1: Health R&D system in the UK



Source: *UK Government*

Funding in medical research and Health R&D is distributed through three main channels (Figure 1):

- Private sector;
- Public sector;
- Research charities.

Private sector medical research primarily includes firms in the human health and pharmaceutical sectors in the UK. According to analysis by the UK Clinical Research Collaboration[2], the private

2 See UKCRC

sector is the largest performer of health-related research in the UK, undertaking half of all research.

This is followed by universities who undertake over a third of all research (36%).

However, these figures do not fully demonstrate the source of funding for research in the UK. While data is typically collected on who is undertaking the research, less is known about the size of the contribution from these different groups to health-related research funding.

Who funds medical research in the UK?

The UK's Governments are not major undertakers of research but provide a significant amount of funding to those performing the research. This is funded primarily through taxation and includes funding by the UK Government, through UK Research and Innovation and the National Institute for Health Research (NIHR) as well as the devolved Governments.

Similarly, medical research charities provide significant funding for health-related research.

A 2018 survey by the UK Clinical Research Collaboration (UKCRC) has attempted to inform this discussion by speaking to 13 member organisations, 25 UK Government and other publicly funded organisations, 12 professional organisations, 87 medical research charities that are members of AMRC and 9 non-AMRC charities.

The survey found that in 2018:

- UK Research and Innovation funded £986 million of health research (39%).
- Other government and public bodies funded £460 million of health research (18%).
- Charities and not-for-profit organisations funded £1,115 million of health research (44%).

Although the response rate for member organisations was 100%, it's important to note that the response rates for UK Government and other publicly funded organisations, professional organisations, AMRC medical research charities and non-AMRC charities were only 63%, 39%, 62% and 16% respectively.

The UKCRC data does not cover all charity research funding. The survey finds that all charities and not-for-profits funded £1,115m of health-related research in 2018, of which AMRC charities made up £1,018m.

However, a small number of AMRC charities did not provide data in the UKCRC survey – their grants are estimated at £42m[3]. In addition, the UKCRC survey does not include a large amount of Cancer Research UK funding for 2018. Difficulties in comparing data provided by financial year and by calendar year make it difficult to precisely estimate this, but time-based estimates of grant funding by Cancer Research UK[4] suggest that the UKCRC figure may underestimate their funding by approximately £65m - £81m.

In total, we therefore estimate that total research funding by charities was £1,222m in 2018, or 46% of all public and third sector medical research funding. This is on a time-apportioned basis where funding is allocated to years based on active research time[5].

3 These figures are sourced from the publicly available AMRC dashboard.
4 Analysis of Grant Costs and Time-Apportioned Spend by Host Institution, Cancer Research UK.
5 This is different to the transaction based estimates used in the modelling which allocates funding to years based on financial

However, data on those undertaking health research and development from the ONS suggests that total UK health research expenditure was £8.67 billion in 2018 – and so total UK health research funding should also match this figure.

Combining this with our estimates of research funding by charities therefore suggests that charities supported approximately 14% of all UK health-related research funding in 2018. It should be noted that charity funding was unusually low in 2018, we estimate that the same figure was around 18% in 2019.

Without charity funding, the UK Government and public bodies would therefore need to increase their direct funding[6] of health-related research by around 85% to cover the shortfall.

The UK is regarded as a global leader in medical research and development, given not only its strong investment and expenditure in R&D – £38.5bn expenditure in 2019 across all areas – but also due to the strength of the UK Life Sciences sector. In 2018, health-related research accounted for approximately 25% of all UK research and development, standing at £8.64 billion[7].

The sector, which encompasses the application of biology and technology to improve health outcomes is both research intensive and plays a key role in the UK's economy.

As part of the 2017 Life Sciences Industrial Strategy, the Government established plans to grow life sciences in the UK. This was underpinned by investment in medical research and development by the government, charities and industry. For example, in 2017 the UK had the highest government expenditure on health R&D out of comparative OECD economies, behind only the US[8].

Which charities fund medical research?

Charity-funded medical research also plays a crucial role in the research environment. Due to the unique purpose of charities, the research they fund is inherently patient centric due to their strong relationships with patients and insights into their priorities. The research funded by charities is also crucial to building the wider research base through developing the skills of the workforce, investing in infrastructure and funding high-risk, high-reward research that de-risks discovery for industry. This investment helps to leverage investment from industry.

Charities are therefore key to the foundation of the research environment that allows for the creation of economic benefit.

In the UK, there are an estimated 166,000 charities operating for a wide variety of causes across society, generating turnover of around £48bn annually[9].

A study by the Charities Aid Foundation in the UK[10] found that in 2018, 64% of people had donated to a charity with the 'most donated to causes' relating to animal welfare and young people (26%); and a quarter of respondents reported having donated to medical charities.

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transactions. AMRC transaction based estimates for 2018 financial years stood at £1,303m.

6 Direct funding as a small amount of charity funding is originally sourced from the public sector.

7 See UKCRC

8 See UK Life Science Indicators

9 See HowCharitiesWork

10 See Charities Aid Foundation

Data provided by the Association of Medical Research Charities, a membership organisation with more than 150 registered charity members, shows that some of the largest members by charitable expenditure are:

- The Wellcome Trust – the largest funder with more than £1bn funded in 2020
- Cancer Research UK
- The British Heart Foundation
- Alzheimer's Society
- Great Ormond Street Hospital Charity

How do charities distribute medical research funding?

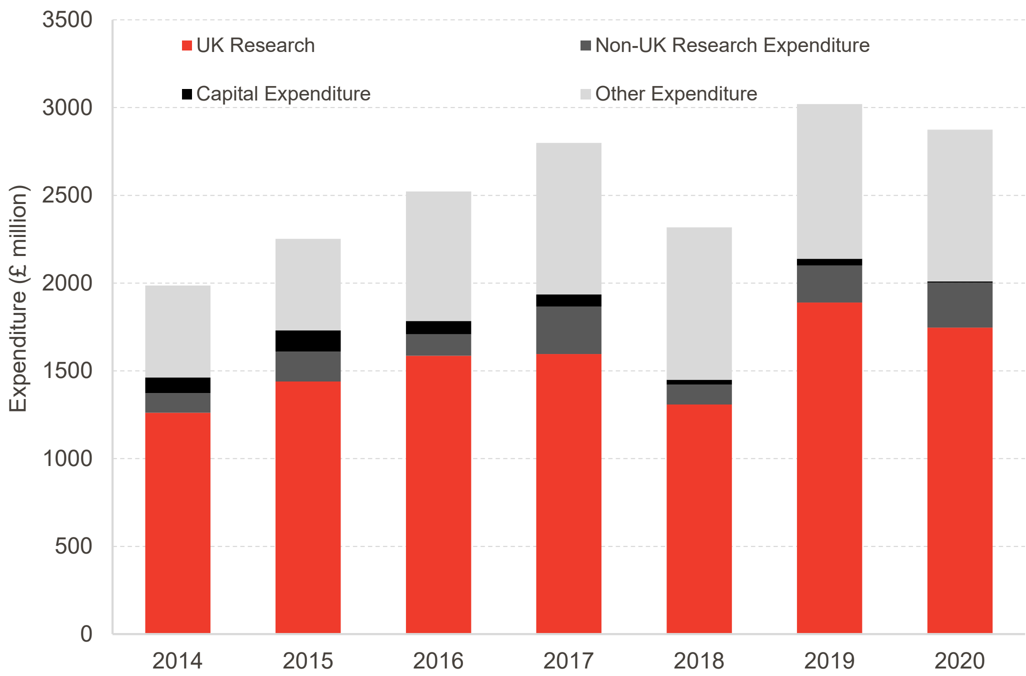
Types of funding

Funds raised by medical charities are distributed through four main channels:

- Research expenditure in the UK
- Funding for research overseas
- Funding for buildings or capital projects
- Funding for non-medical research such as welfare support or care funds

UK research expenditure accounted for the majority of medical research funding by charities in the UK in 2020, with 60% of funding allocated. Around 30% of funding is attributable to non-medical research expenditure such as welfare, support and education services.

Chart 1: UK medical research charity expenditure by type, 2014 - 2020



Source: *AMRC*

Both UK and other research expenditure have remained at similar levels since 2014.

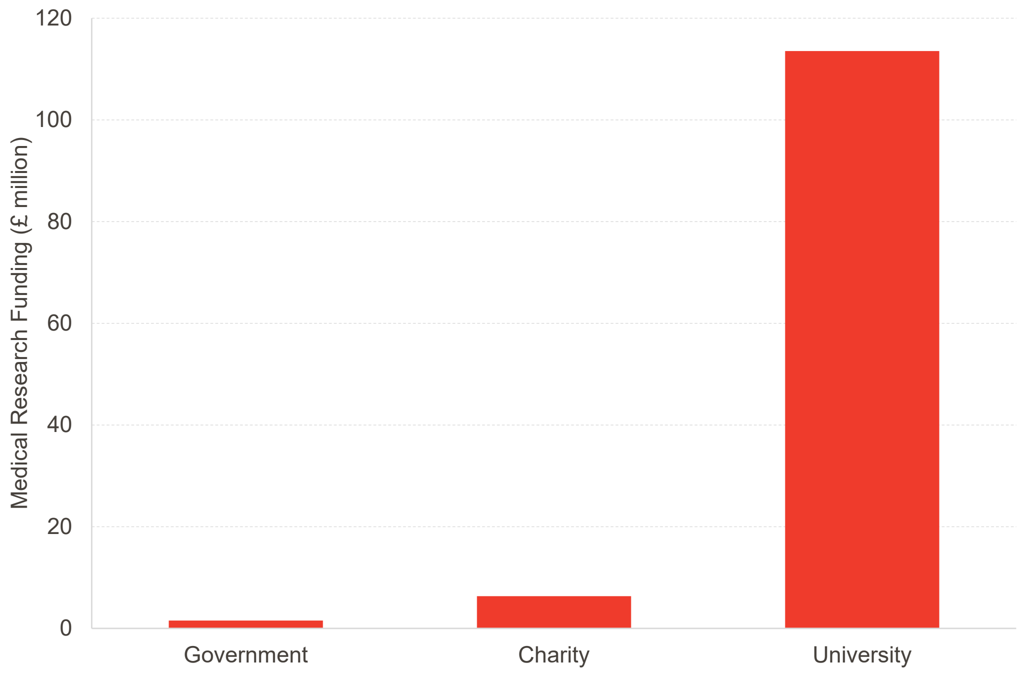
The remaining 10% of expenditure has been allocated across research conducted overseas and capital expenditure such as building and capital projects. Foreign medical research accounted for 9% of total medical research in 2020, with less than 1% attributed to capital expenditure.

For the purpose of this report, we focus explicitly on the economic impact of research expenditure in the UK only. The analysis does not account for capital expenditure, non-medical research and research undertaken in other countries.

Recipients of funding

The member charities of the AMRC distribute UK medical research funding across several types of organisations and institutions. The largest type of recipient is universities, which received 78% of the total value of charity research grants in 2018.

Chart 2: Research grants by institution, 2018



Source: *UKCRC*

Medical research funding is also distributed across a number of health areas and research activities. For example, in 2018, 31% of AMRC member charities' funds went to cancer and neoplasms research, 19% to generic health related research, 11% to infection research, with the remainder split across causes such as cardiovascular, neurological and mental health research[11].

11 See AMRC

The role of universities

Not only do universities have commitments to provide high quality education, they also conduct a significant amount of research. Medical schools and other relevant bodies within universities have core aims to provide ground-breaking research and technologies.

In 2019, the higher education sector was the largest recipient of medical research funding by charities.

Whether it is the development of a new drug, improvements in existing treatments, or more recently, helping to produce vaccinations against Covid-19, universities play a major role in medical research.

In recent years, examples of medical research conducted by universities and funded by charities include:

- Research funded by the British Heart Foundation at the University of Manchester into the repurposing of amlodipine, a drug used to treat high blood pressure, that has shown promise in treating a specific type of vascular dementia.
- A Cancer Research UK study in a collaboration between the University College London with the Universities of Glasgow, Oxford, Leeds and Cardiff that successfully trialled a new drug that helps slow regrowth of tumours among bowel cancer patients.
- The Wellcome Trust UK supporting the creation of the Centre for Synaptic Plasticity between the Medical Research Council and the University of Bristol to provide pivotal research into brain disorders including epilepsy and memory loss.

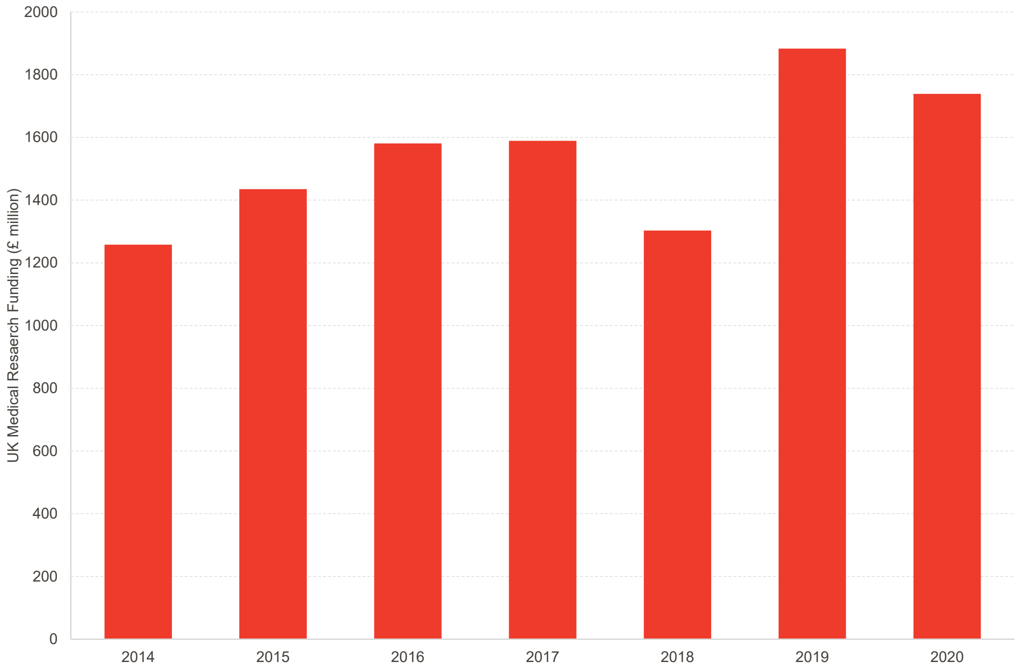
Growth of UK medical research funding by charities over time

Medical research expenditure[12] has rapidly increased since 2014, with £1.88 billion of UK medical research funding distributed by AMRC charities in 2019, Chart 3.

2020 experienced a fall in medical research expenditure by charities. Reported expenditure was £144 million (around 8%) lower than in 2019. This can be attributed to the pandemic, with in-person charity retail operations having to close and household finances at risk.

12 This is expenditure by 154 member charities of the Association of Medical Research Charities.

Chart 3: Total AMRC medical research expenditure in the UK, £ million, 2014 - 2020



Source: *AMRC*

The Covid-19 pandemic impact on charity-funded medical research

The ongoing Covid-19 pandemic has significantly affected medical research in the UK.

National lockdowns have slowed down lab-based research and the tightened financial situation of many households, combined with national lockdowns has affected charity income from donations and retail sites.

A survey of AMRC member charities[13] after the first peak of Covid-19 in May 2020 highlighted a 38% loss in fundraising income. Across the UK, funding from AMRC charities, excluding Wellcome, fell from £917 million in 2019 to £776 million in 2020, a drop of 15%. This trend is expected to continue with a survey of member charities estimating that funding will fall to £653 million during 2021.

As well as this, an AMRC survey[14] of over 500 early career researchers supported by charities found that two thirds solely rely on charities to support their salaries.

The delays seen to charitable funding during the pandemic means around 60% of charities have had to reduce or cancel support for early career and skilled researchers.

The direct consequences of these cuts are evident, with 40% of early career researchers admitting to having considered leaving medical research, and 82% of researchers feeling less secure in the profession.

The resulting uncertainty in the sector, caused by the pandemic, means that not only might the sector lose good talent but could also lead to long-term shortages in highly skilled medical

13 See AMRC
14 See AMRC

researchers. Additionally, in May 2020, the AMRC forecasted that the sector may not return to pre-pandemic levels for 4-5 years, leading to potential implications for the further advancement of medical treatments in the UK.

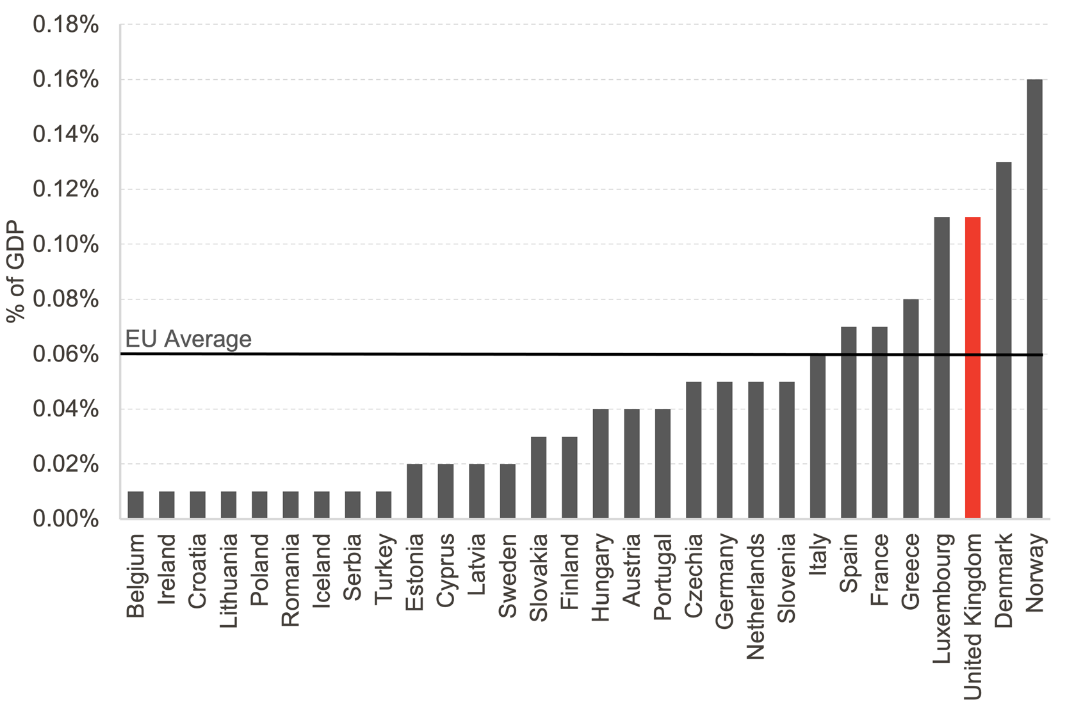
The benefits of medical research and development

How much R&D does the UK perform?

In 2019, net UK Government expenditure on R&D was £12.39bn, of which 21% was health related research[15]. The only other category that received more funding was general advancement of knowledge through university research. Whilst international comparisons of total public, private and third sector health related R&D are not available, we can compare UK public expenditure on health-related R&D with European countries. The UK performs very well for health-related government research and development. It ranks third behind Denmark and Norway.

In 2019, health research and development by government accounted for 0.11% of UK GDP, which has remained at similar levels since 2011.

Chart 4: Health related government research and development spend, EU comparison, 2019



Source: *Eurostat*

The UK Government's commitment to drive R&D in the UK positions the UK as specialists in research. The KPMG global technology innovation report[16] in 2018 suggested that the UK was the

15 See UK Research and Development spending
16 See KPMG

third most promising global centre of innovation and technological development, behind only the US and China.

Further to this, the report also suggested that the UK was the 4th most prosperous country for the next wave of disruptive technological breakthroughs. This highlights that not only is the UK a global leader in research and innovation, but also the potential for this area of the economy to grow further.

Indeed, the UK Government Industrial Strategy points to the UK as "one of the best places in the world for life sciences". This is a result of the complementary trifecta of government, private and charity medical research and development funding which contributes substantially to research and development in the UK. This innovation ultimately boosts the UK economy over the long term.

The benefits of health R&D

In 2019, total expenditure by all institutions on research and development was £38.5bn, or around 1.74% of total UK GDP.

Research and development have also always been a priority for the UK Government, with expenditure on R&D increasing 96% in real terms over the past three decades.

Further to this, the Government set out plans in its 2017 Industrial Strategy to increase R&D spend to an equivalent of 2.4% of GDP, highlighting the desire to drive research in the UK. They also laid out their roadmap in July 2020 which detailed plans to boost the UK's scientific, research and innovation capabilities by committing to reach an annual public expenditure of £22bn by 2024.

The UK Government also set out its R&D People and Culture Strategy in July 2021. The strategy, which aims to improve the flow of ideas between academia, business and other sectors, is the first R&D strategy for the UK that sets out a vision for research and development across all sectors[17].

R&D can boost output and productivity in an economy. As technology advances, we can produce more with the same amount of resources and so productivity improves. As new methods and technologies are discovered, there are knowledge spill-overs into the public, private and third sectors. Productivity is a key long-term driver of economic and wage growth.

There are many socio-economic benefits resulting from increased R&D, particularly in the case of health-related research. R&D has the ability to improve lives through improved health care; develop skills through new processes and ideas; and improve overall quality of life with advancements in medical technologies and treatments.

Medical research not only helps to improve overall health outcomes for society, but can improve people's quality of life.

In 2018, health-related research accounted for approximately 25% of all UK research and development, standing at £8.64 billion[18].

Some examples of successful medical related R&D projects funded by charities include:

17 See R&D People and Culture Strategy
18 See UKCRC

- The use of artificial intelligence-enhanced tools to create a combination of drugs to help to fight incurable brain cancer in children. The project, conducted by the Institute of Cancer Research and the Royal Marsden NHS Foundation Trust, is funded by several charities including Cancer Research UK, Children with Cancer UK and The Royal Marsden Cancer Charity.
- Research at the University of Sheffield, funded by the British Heart Foundation, that is developing a computer model that can use heat map technology to identify artery blockages. The research aims to identify potential heart conditions before health problems occur such as heart disease or a heart attack.
- An Epilepsy Research UK funded project aimed at predicting seizures of individuals with epilepsy in the UK. The project is designing technologies such as EEG caps and smartwatches that can monitor individuals' brain activity and indicate if a seizure is likely or imminent.

Whilst these are only a few examples of ongoing and successful medical research projects funded by charities, the list is endless and medical research ranges across all health conditions, from the rarest diseases to the most common illnesses.

As well as the benefits to society, there are wider benefits to medical research as a whole.

For example, research by Burridge et. al (2016)[19] found that increases in government and third sector funded research can increase private sector funding. They find that increasing expenditure in the public sector and third sector by 1% increases private sector expenditure nearly 1:1 within a year.

However, whilst the primary intention of medical research is to improve our health, medical research spending by charities also provides a significant contribution to the economy.

19 See Burridge et. Al (2016)

3. Modelling the contribution of medical research expenditure

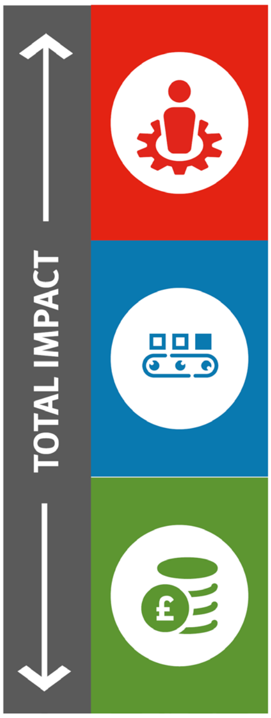
Improving treatments and outcomes for the people of the UK is the priority for medical research. However, it is not the only achievement. Medical research expenditure funded by charities also makes a substantial contribution to the economy, supporting economic growth and jobs across the whole of the UK.

In this section, we use our detailed model of the UK economy to estimate the economic impact of medical research expenditure funded by charities. We focus on the impacts of spending on supply chains and wages in the UK. Notably, our estimates do not include the significant beneficial impacts of:

- Improved levels of health in the UK which help unlock the potential of the workforce, reduce health service costs, and improve quality of life.
- The impact of positive knowledge and innovation spill-overs of medical research on knowledge within the private, public and third sectors drives economic growth over the long term.
- The value of drugs, patents and technologies that are created as a result of the research.

Interpreting our results

The results highlight the direct, indirect and induced impacts of medical research expenditure in the UK. The diagram below explains each of these impacts.



Direct impacts

Medical research spending by charities funds research and development in universities and medical organisations. To perform their research they purchase goods and services from suppliers. The reaction of suppliers to meet this demand generates output, GVA and employment.

+

Indirect impacts

Their suppliers make purchases from their own suppliers who, in turn, have their own suppliers. The indirect impact measures the output, GVA and employment generated throughout the national supply chain.

+

Induced impact

The employment gained due to the direct and indirect impacts leads to additional wages. These wages are spent on goods and services around the nation, further boosting the economy.

Our estimates are presented using output, GVA and FTE jobs.

- Output is the value of all goods and services produced.
- Gross value added (GVA) is a measure of the contribution to an economy and is similar to GDP - gross domestic product. Put simply, it is output minus the cost of goods and services used in production.
- Full-time Equivalent (FTE) Jobs is a measure of jobs that accounts for the spread of part-time and full-time work across sectors of the economy. One FTE is equal to one job working full-time hours, or two part-time jobs.

Total Impact

In 2019, medical research funding by charities supported £5.9 billion output, £3.5 billion GVA and 51,350 jobs in the UK.

Of these jobs, 22,150 are supported directly in universities and medical organisations receiving funding, while a further 29,175 jobs are supported across the UK as a result of spill-over effects.

The pandemic has had an impact on funding. Medical research funding provided by charities fell from around £1.88 billion in 2019 to £1.74 billion in 2020. As a result, there was less output and GVA, and fewer jobs supported by medical research funding by charities in 2020 than in 2019.

As a result of this fall in funding, as many as 3,950 jobs across all sectors of UK economy were at risk of being lost. The true impact on job losses is likely much smaller than this figure due to significant government interventions such as the Job Retention Scheme.

Table 1 to Table 3 highlight the direct, indirect (supply chain spill-overs) and induced (wage spending spill-overs) impact of medical research expenditure by charities in the UK.

Table 1: Economic impact of medical research funding by charities on UK output, £ million, 2019-2020*

	2019	2020
Direct	1,880	1,740
Indirect	950	870
Induced	3,090	2,860
Total	**5,920**	**5,470**

**Rounded to the nearest 10. Columns may not sum as a result.*

Source: FAI Calculations

Table 2: Economic impact of medical research funding by charities on UK full-time equivalent jobs, 2019-2020*

	2019	2020
Direct	22,150	20,450
Indirect	8,275	7,625
Induced	20,925	19,300
Total	**51,350**	**47,400**

**Rounded to the nearest 25. Columns may not sum as a result.*

Source: FAI Calculations

Table 3: Economic impact of medical research funding by charities on UK GVA, 2019-2020*

	2019	2020
Direct	1,230	1,130
Indirect	500	460
Induced	1,720	1,590
Total	**3,450**	**3,190**

Rounded to the nearest 10. Columns may not sum as a result.

Source: FAI Calculations

Economic multipliers

While large industries often have significant impacts, economic multipliers can be used to understand the value for money that an industry supports in the economy.

Economic multipliers tell us the amount of output, GVA and jobs supported by a £1 million expenditure on final demand (for example: government spending, exporting, research and development). High multipliers typically describe industries that are strongly integrated with UK supply chains and spend significant amounts on wages.

We found that a pound spent by medical research funding by charities has a significantly larger impact on output, GVA and jobs than the average pound spent in the UK.

Every £1 million spent on medical research funding by charities in the UK supports:

- £3.15 million of output,
- £1.83 million of GVA, and
- 27 jobs.

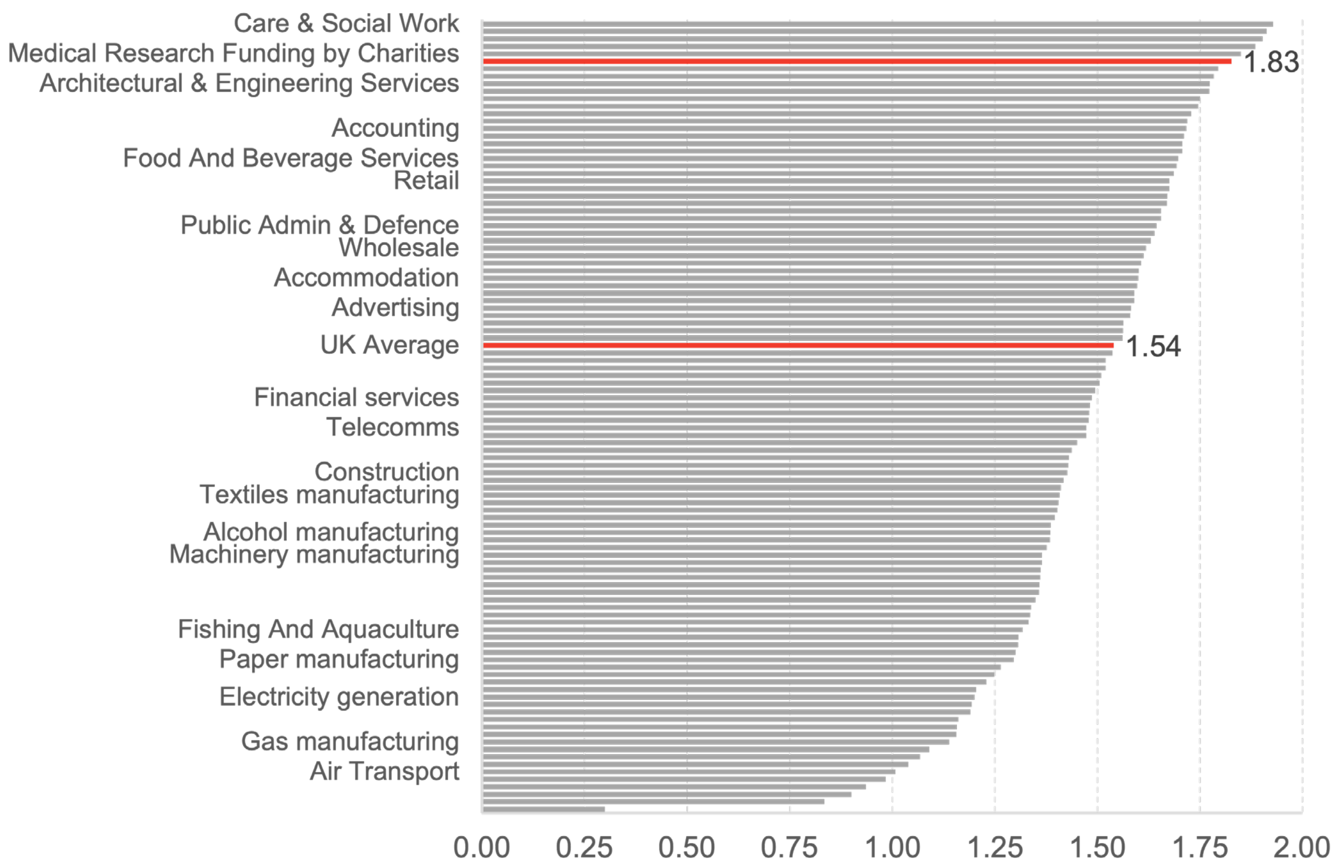
How does this compare? On average across the whole economy, every £1 million spent in the UK supports:

- £1.62 million of output,
- £1.54 million of GVA, and
- 21 jobs.

Chart 5 and 6 show the GVA-output multipliers and FTE jobs-output multipliers for medical research funding by charities compared to 104 sectors[20] of the UK economy. Medical research funding places 5th for GVA-output multipliers and 14th for jobs-output multipliers.

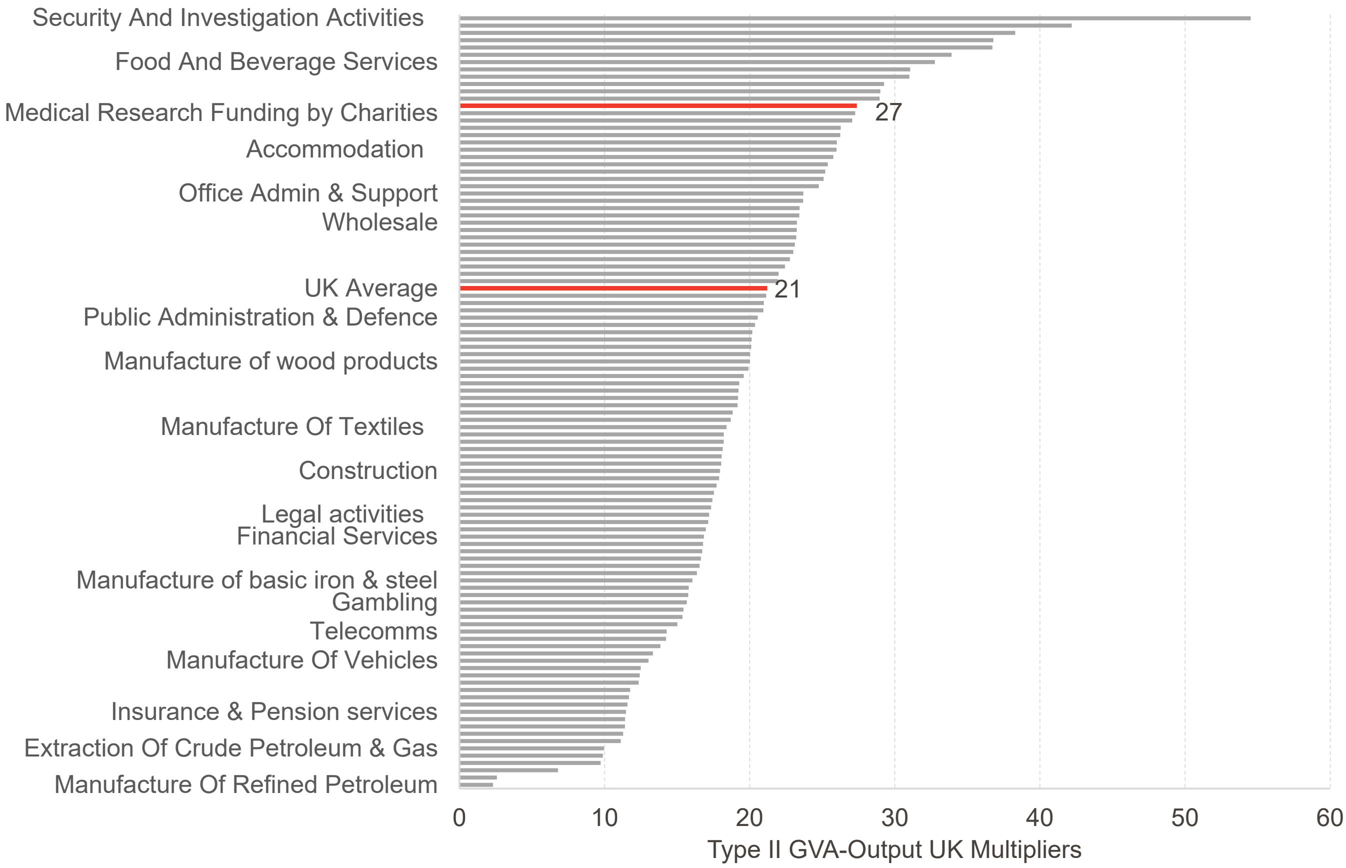
20 The 'activities of households as employers of domestic personnel' sector has been excluded as it is not a conventional industry.

Chart 5: Comparison of Type II GVA-output multipliers across 104 sectors of the UK economy & medical research funding by charities. Selected sectors labelled.



***Source:** FAI Calculations*

Chart 6: Comparison of Type II FTE jobs-output multipliers across 104 sectors of the UK economy & medical research funding by charities. Selected sectors labelled.



Source: *FAI Calculations*

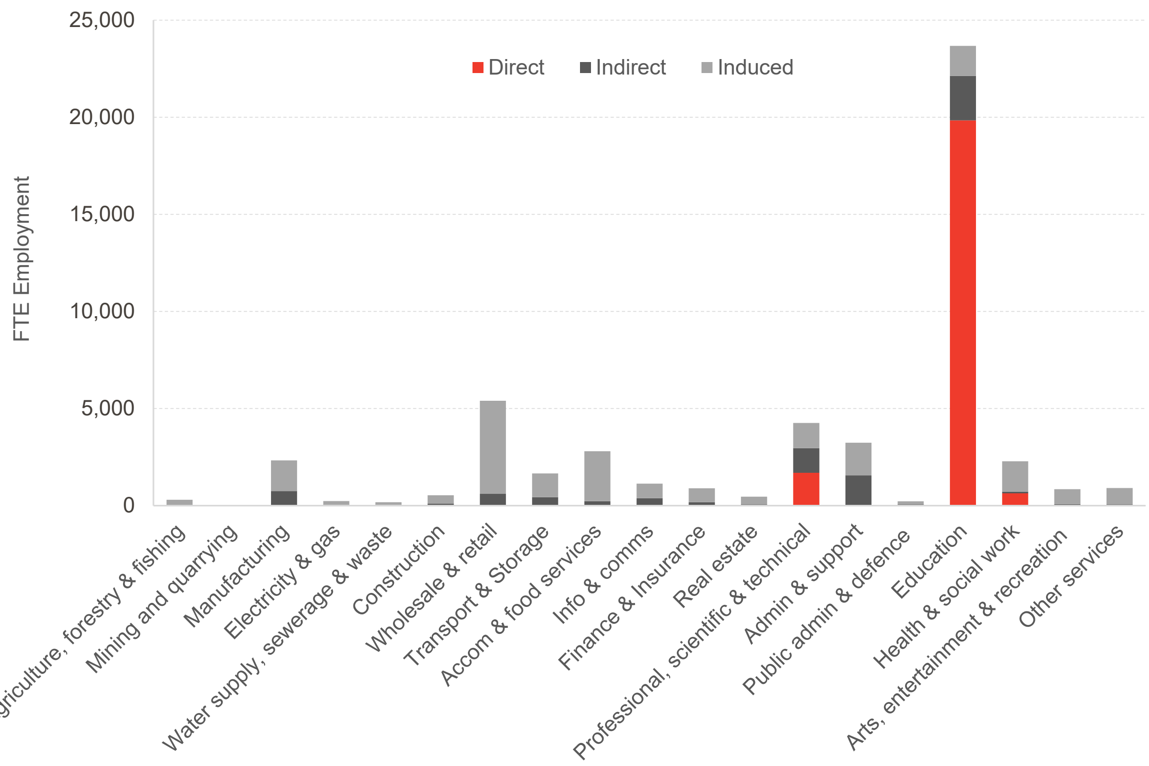
Impact by sector of the UK economy

Chart 7 shows the spread of the FTE employment supported by medical research across the industries of the UK.

Unsurprisingly, the direct employment as a result of medical research funding by charities lies in the education, research and health sectors. However, the spill-over impacts extend into many other sectors.

For example, medical research funding by charities supports around 3,200 jobs in the administrative and support services sector, 5,400 FTE jobs in wholesale and retail, and over 2,300 jobs in manufacturing.

Chart 7: Direct, Indirect and induced contributions of medical research spending, 2019



Source: *FAI Calculations*

Comparison of medical R&D by charities and total business R&D

Our results above estimate high multipliers associated with charity-funded medical research. In this section, we use the same methodology to estimate the multipliers of all research and development undertaken by businesses[21].

Total R&D performed by UK businesses was £25.9bn in 2019, with £25.5bn disclosed on a sectoral basis. The sectors which perform the majority of business R&D are the scientific research & development sector, the vehicle and transport equipment manufacturing sector, the computer programming sector, and the architectural and engineering services sector.

Using our model of the UK economy, we can estimate the impact of the spending associated with this research and development.

Similarly to our modelling of charity-funded medical research, we do not estimate the impact of new technologies or advancements which result from the R&D. The full impact of R&D would be larger than the associated expenditures suggest.

21 Business research and development is used as the ONS publishes detailed information on business R&D by sector. This sectoral detail is required for the modelling.

We find that every £1 million spent on research and development by businesses in the UK supports:

- £2.94 million of output,
- £1.19 million of GVA, and
- 15 jobs.

The multipliers of medical research expenditure are therefore estimated to greatly exceed those of total research and development by businesses.

However, it is important to be mindful that these estimates cover the impact of associated expenditures only. For example, we are not comparing the economic impact of an improvement in electric cars with a new treatment for a disease.

Data and methodology

Data on medical research funding

Data on medical research by charities was provided by two sources.

The first source is the UK Health Research Analysis in 2018. This is a survey of the main funders of clinical research in the UK and is undertaken by the UK Clinical Research Collaboration (UKCRC). This survey covers 22,500 projects from 146 organisations and provides a highly detailed view of medical research funding by organisation in 2018.

The second data source is the Association of Medical Research Charities (AMRC), a membership organisation that supports medical research charities. The AMRC collects data on UK medical research expenditure annually from its 150+ members.

There are several differences between the AMRC and UKCRC datasets.

The AMRC surveys almost all UK charities funding medical research and has values for each year since 2014, while the latest UKCRC dataset represents 2018 only. Only 62% of AMRC membership responded to the UKCRC survey, however the respondents accounted for around 97.5% of total UK expenditure.

The AMRC data is a sum of research expenditure reported by the annual accounts of charities. As different organisations have different financial year start and end dates, the figures can therefore differ from calendar year values. These data also report the amount of grant provided that year, but this does not necessarily reflect the year that the research is undertaken.

Comparatively, the UKCRC dataset aggregates values of grants based on the years the research was undertaken. For example, a three year grant which finishes on the 31st December 2018 would have one third of the grant value assigned to 2018.

Other differences between the figures and the datasets can also exist. After discussion with the UKCRC, some potential differences exist due to the difficulty of allocating funding shared between charities to the individual charities.

But most critically, while the AMRC data is an excellent source of annual research data, it only provides the total value of UK medical research expenditure by year or by organisation. It does not provide a breakdown of research funding by nation or by type of recipient. We have therefore used AMRC data to inform the annual totals, while using detailed UKCRC data to apportion these totals into regions and recipient types.

While we believe that combining the data gives the most accurate representation of medical funding in the UK, this does come with assumptions and drawbacks. For example, proportions for the four nations by funding recipient type are fixed. Therefore, if one nation or recipient type was impacted more significantly than others (e.g. during the pandemic), then this data will not reflect the extent of this change.

Data for constructing the model

Our economic models use Input-Output tables from the nations of the UK. These include the ONS UK Input-Output table, the Scottish Government's Input-Output table and NISRA's Input-Output table.

Input-Output tables describe the flow of goods and services around the economy. They show how industries buy and sell from each other, compensate labour, and sell to sources of final demand such as Government, households and exports. Input-Output tables are a simple transformation of Supply and Use tables.

While individual data sources can suffer heavily from accurate measurement, bias, definitions and other issues, Supply and Use tables are constructed from many government datasets. The inclusion of many datasets allows for (a) each dataset to act as a check for other datasets and (b) to place heavier weight on more reliable datasets. As a result, Supply and Use tables are considered the cornerstone of National Accounts. These, along with input-output tables, are produced by many advanced economies and are used to create significant economic statistics, such as GDP.

We have also introduced employment data to produce estimates of employment impacts. These data sources include the ONS Workforce Jobs dataset and the ONS Business Register and Employment Survey.

Modelling methodology

We use input-output modelling to generate the estimates. This modelling methodology is well established and dates back to 1951 and resulted in the creator, Wassily Leontief, receiving the Nobel Memorial Prize in Economics.

It has widespread use in Government and academia. For example:

- UK Government Department for International Trade: Evaluating the impact of exports on UK jobs and incomes
- Scottish Government: Scottish Budget 2020-2021: carbon assessment
- OECD Trade in Value Added statistics

In National Accounts, charities can be found within both “industries” and “non-profit institutes serving households” (NPISH). This presents a difficulty from the perspective of modelling typical expenditures. Instead, our modelling focuses on the economic benefits associated with an uplift in research and development. This interpretation allows us to use economic multipliers – which model the economy-wide impacts of a change in final demand (e.g. research and development).

Once the model was created, data on UK medical research funding by charities was then used to map funding recipients (i.e. those with boosted R&D) to sectors of the economy. By sector, the major recipients of UK medical research funding by charities are:

- SIC 72: Scientific Research and Development
- SIC 85: Education
- SIC 86: Human health activities

In this report, three separate models have been developed to each cover a country – the UK, Scotland and Northern Ireland. Unfortunately, it is not possible to create a high-quality model for Wales as the Welsh Government currently does not publish the required data. Instead, we have used Welsh data to regionalise the UK model.

Our estimates model the impact of an uplift in research and development expenditure in education, research and development organisations and medical organisations.

The impact of an increase in research and development in these sectors results in the sectors increasing their output (i.e. to create R&D they must perform R&D). This is known as the direct impact.

These industries purchase goods and services in order to undertake their activities (e.g. electricity to power buildings, glass vials for experiments or research time from other organisations). These suppliers, in turn, purchase goods and services from their own suppliers and so on, down the supply chain. This is known as the indirect impact.

Employees are required to produce the additional output associated with both the direct and indirect impacts. These employees are paid wages, which are spent on goods and services around the UK. This results in additional output and employment, particularly in industries such as retail and food and accommodation services (i.e. bars, restaurants, hotels). This is known as the induced impact.

The total uplift in output in the economy resulting from an increase of £1m of final demand (e.g. research and development) is known as the output multiplier. Similarly, we can produce employment-output multipliers and GVA-output multipliers which represent the increase in employment or GVA from an increase of £1m of final demand.

The size of the multiplier is primarily affected by the proportion of (a) purchases from other industries [mainly affecting the direct and indirect effect], (b) leakages from the economy in the form of profits and imports [which reduces the multiplier at each stage], and (c) employee compensation such as wages [proportionately high wages increase the induced impact].

Estimates of multipliers for total business R&D expenditure were produced by mapping business R&D data, sourced from the ONS Business Enterprise Research and Development dataset, to sectors.

What are output, GVA and FTE jobs?

Our estimates are presented using output, GVA and FTE jobs.

Output: The value of all goods and services produced. This is most easily thought of as the turnover of firms. However, output is selected over turnover because a large amount of activity is not undertaken by firms (e.g. by government and third sector which can have no turnover but produce a large amount of goods and services).

GVA: Gross value added is a measure of the contribution to an economy and is very similar to GDP (gross domestic product).

It is a preferred measure than output as a firm could buy £1m of goods and sell these on for a further £1m – clearly no value has been created here despite output counting this as a £1m contribution.

GVA can be described simply as subtracting costs of goods and services inputs from the sales. This is not the same as 'profits' since GVA also includes taxes on production, compensation of employees (e.g. wages, pensions), and gross operating surplus (e.g. company or self-employed profits). And an organisation can have no profit but can contribute to the economy by paying salaries.

Full-time Equivalent (FTE) Jobs: Full-time equivalent simply tries to account for the fact that supporting a part-time job does not have the same impact as supporting a full-time job. For calculating FTE, a full-time job equals one FTE while a part-time job equals half an FTE. In particular this avoids large overestimation in industries such as retail.

It should be noted that, while we have used the terms interchangeably in this report, there is a difference between "employees", "employment" and "jobs". For example, employment includes self-employment, while employees does not. And one employee can have multiple jobs.

Modelling assumptions and limitations

The choice of model can influence the resulting estimates. Input-output modelling is the correct choice for the research question as it can capture the economy-wide impacts of spending at a fairly granular level.

However, input-output modelling requires assumptions. Some of the key assumptions include:

- There is no restraint on the supply side – this becomes problematic with extremely large additional expenditures (e.g. a £400 billion construction project would result in a shortage of construction workers).
- Price impacts are not considered. Again, this is problematic for very large demand side shocks. In the above example, the cost of construction materials would increase, resulting in less output.
- There is no substitution between technologies.
- Unless otherwise specified, inputs are treated as sector averages.

The final assumption is important as medical researchers within a sector could have different expenditures to the sector as a whole. Without a survey of the expenditures of all medical researchers, it is difficult to say how this could affect the results. However, such a survey would likely be cost prohibitive and researchers may be unaware of all the costs associated with their organisation (e.g. such as building maintenance and electricity).

These assumptions also apply to the multiplier results for total business R&D expenditure.

Glossary

Output: The value of all goods and services produced.

GVA: A measure of contribution to an economy equal to output less intermediate consumption (i.e. purchases of goods and services as inputs).

GDP: A measure of economic growth, equal to GVA plus taxes less subsidies on products.

Employment: A measure of people that includes employees and self-employed. This differs from jobs, for example one employee can have multiple jobs.

Full-time equivalent: Using FTE measures of jobs and employment attempts to account for the difference in economic impact between part-time and full-time work. One full-time equivalent employee is equal to one person working full-time, or two people working part-time.

Direct impact: An increase in the final use of a sector results in organisations in the sector reacting by increasing their output. This is called the direct impact.

Indirect impact: Firms that increase their output as part of the direct impact must purchase goods and services from their suppliers in order to produce this output. In turn, their suppliers must increase purchases from their suppliers and so on. The sum of the impacts down the supply chain is called the indirect impact.

Induced impact: Employment is generated as a result of the direct and indirect impacts. Employees are paid wages which are then spent on goods and services. This household spending impact is called the induced impact.

Spill-overs: For input-output modelling results, spill-overs typically refer to the indirect and induced impacts.

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