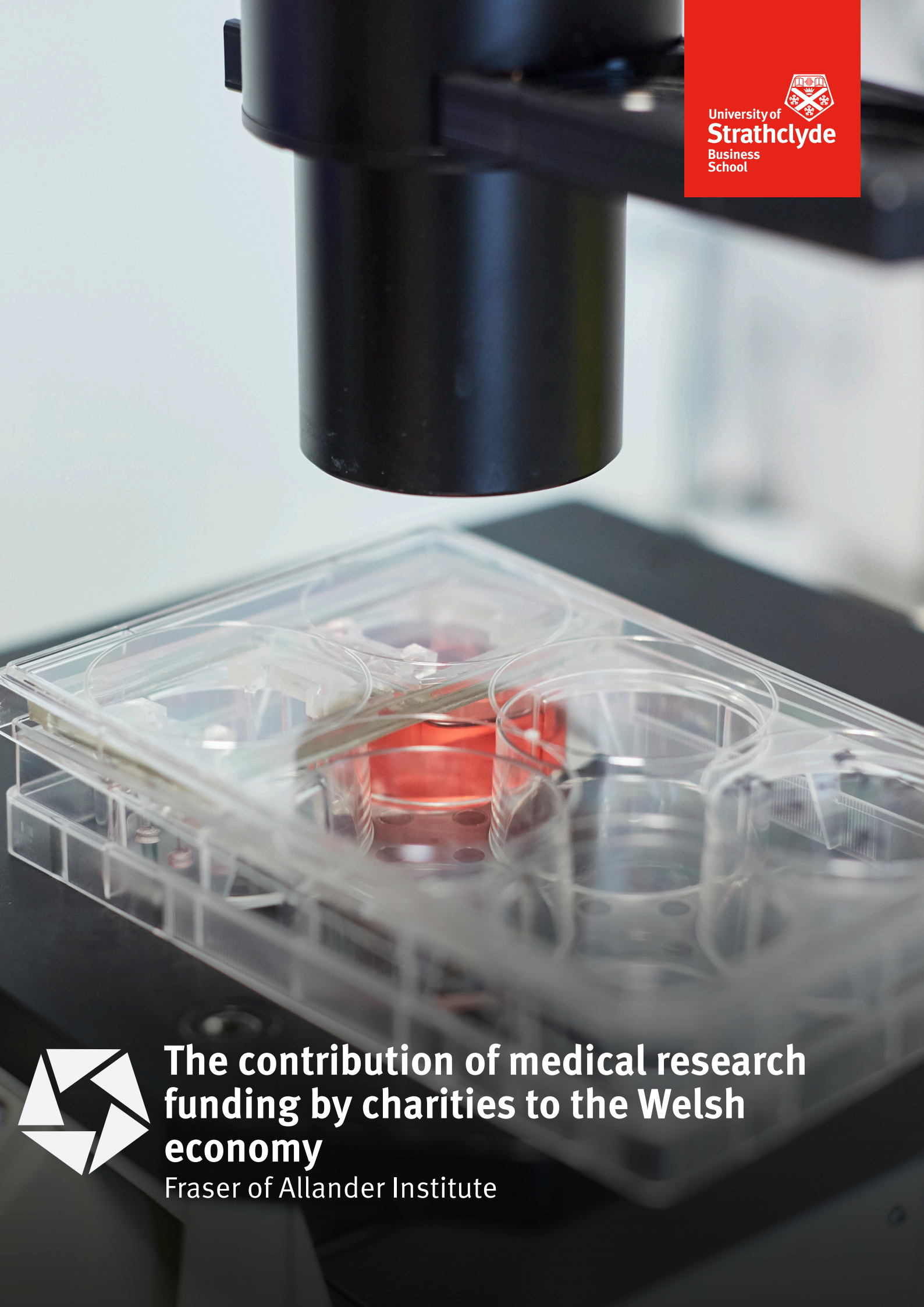

University of Strathclyde Business School

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

Fraser of Allander Institute

UNIVERSITY of STRATHCLYDE
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The Fraser of Allander Institute

Disclaimer

The analysis in this report has been conducted by the Fraser of Allander Institute (FAI) at the University of Strathclyde. The FAI is a leading academic research centre focused on the Scottish economy.

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 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 Welsh economy and 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 like Covid-19.
- Charities are major funders of medical research. Medical research funding by charities has been estimated to be 35% of all third sector and public funding of medical research in Wales, with active research funding of £21m in 2018.
- Without charity funding, the public sector would therefore need to increase their direct funding[1] of health-related research in Wales by an estimated 53% to cover the shortfall.
- 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 Welsh 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 Welsh 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 the Welsh economy in terms of jobs, output, and GVA (Gross Value Added). This includes the direct impact of research on universities and medical organisations, as well as wider impacts on supply chains, job creation and wages.
- Our results estimate that in 2019, medical research funding by charities supported 975 jobs, £86m in output and £55m in GVA in Wales.
- 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 is estimated to have put 100 jobs, £9m output and £6m GVA at risk in Wales.
- We also estimate multipliers for medical research funding by charities. Every £1 million spent on medical research funding in Wales by charities supports:
    - £2.30 million of output
    - £1.47 million of GVA
    - 26 jobs

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

WALES
THIRD SECTOR MEDICAL RESEARCH

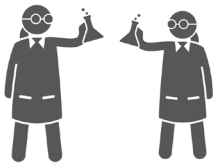
£86m

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

Third sector medical research supported a total of **975 FTE jobs** across the Welsh economy in 2019

Charity medical research spend has the **23rd highest** output multiplier out of 104 UK sectors

Medical research spend by charities in Wales was **£24m** in 2019



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

Charity medical research spend has the **4th 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 **£55m** of GVA across the Welsh economy in 2019

[1]*Source: UKCRC*

1. Introduction

Medical research by charities is an important component of the Welsh 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 Welsh economy.

One of the key drivers for medical research in Wales is the growing life sciences sector with 12,000 people employed across 300 companies and an annual turnover of around £2 billion[1].

This is reflected in the Life Sciences Hub, established by the Welsh Government. This institution aims to build on the life sciences sector by boosting innovation and improving collaboration between health, industry, charities, social care and academia.

The Covid-19 pandemic has also accelerated the role that R&D has to play in the Welsh 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.

This report assesses the economic contribution and wider spill-over effects of medical research expenditure by charities to the Welsh economy. The analysis focuses only on the economic impact of charity-funded medical research expenditure in Wales. It does not account for 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 Wales.

This report is divided into the following sections:

- Section 1 provides an overview of medical research funded by charities in Wales.
- Section 2 evaluates some of the socio-economic benefits of R&D, and in particular, health R&D in Wales.
- Section 3 evaluates the economic contribution of third sector medical research expenditure in Wales in terms of economic output, Gross Value Added (GVA) and jobs.

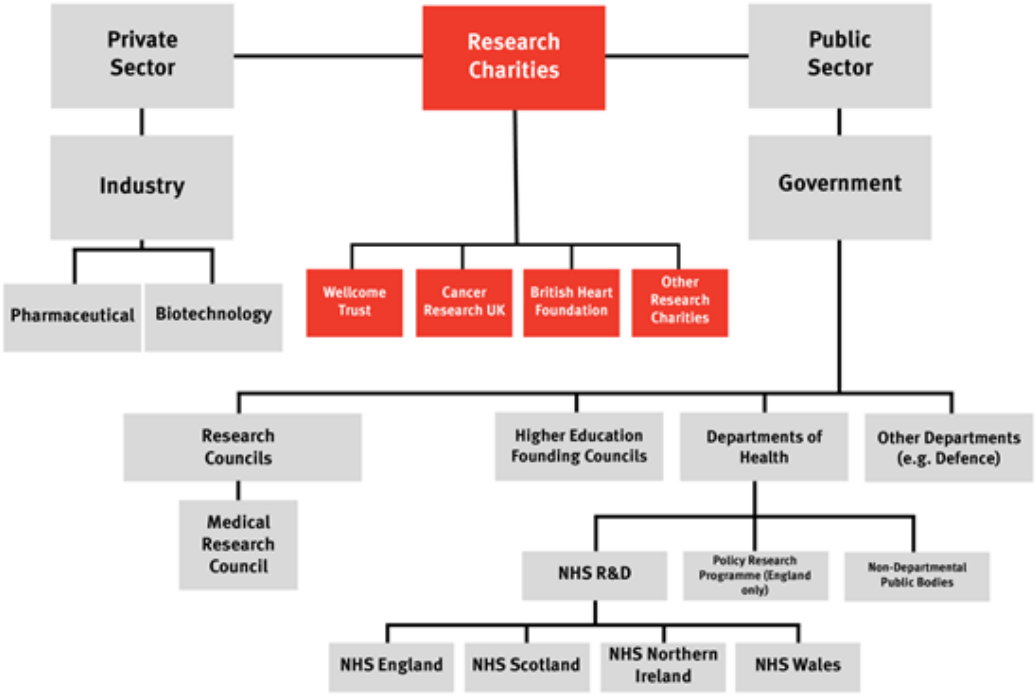
1 See UK Life Sciences Industrial Strategy

2. Medical Research in Wales

Who undertakes medical research in Wales?

Medical research is an integral part of the Welsh economy and the nation benefits greatly from its reputation of world-leading research. In part, this reputation has been built on unique characteristics of Wales' 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 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 medical 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.

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 Welsh Government, Health and Care Research Wales and the Higher Education Funding Council for Wales, as well as the UK Government, through UK Research and Innovation and the National Institute for Health Research (NIHR).

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 the UK 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.

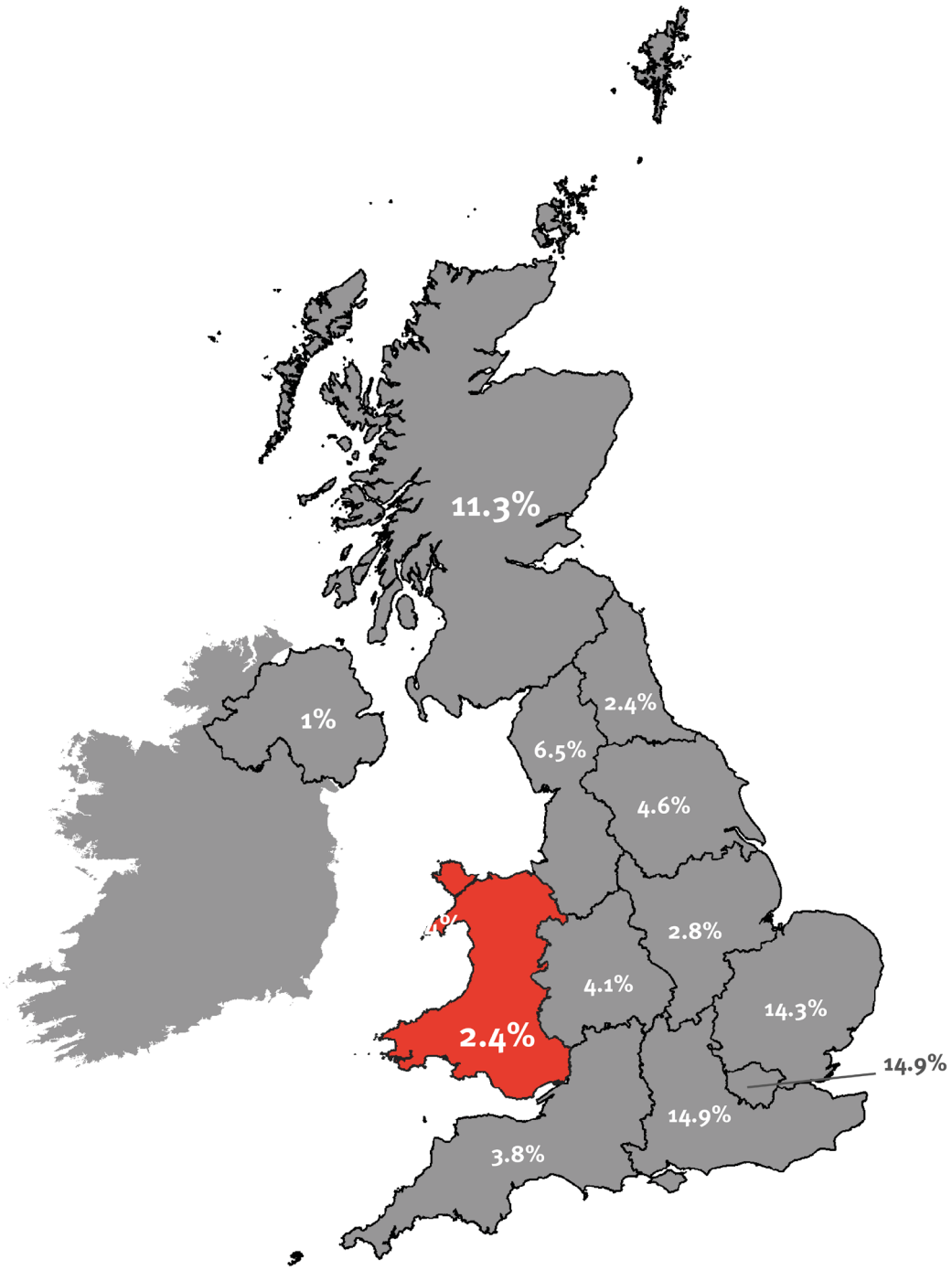
The UKCRC data does not cover all charity research funding. The survey finds that all charities and not-for-profits funded £1,115m of health-related research in 2018, of which AMRC charities made up £1,018m.

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.

2 See UKCRC
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.

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].

Diagram 2: Public and charity health related R&D by devolved nation and parts of the UK, 2018



Source: *UKCRC*

5 This is different to the transaction based estimates used in the modelling which allocates funding to years based on financial transactions. AMRC transaction based estimates for 2018 financial years stood at £1,303m.

Using the UKCRC dataset, we find that the third sector supports £21m of medical research expenditure in Wales and the public sector supports £40m.

Without charity funding, the public sector would therefore need to increase their direct funding[6] of health-related research in Wales by an estimated 53% to cover the shortfall.

Changes in Welsh medical research funding by charities over time

Charity-funded medical research plays a crucial role in the research environment. Due to the unique purpose of charities and their strong relationships with patients and insights into patient priorities, the research they fund is inherently patient-centric.

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.

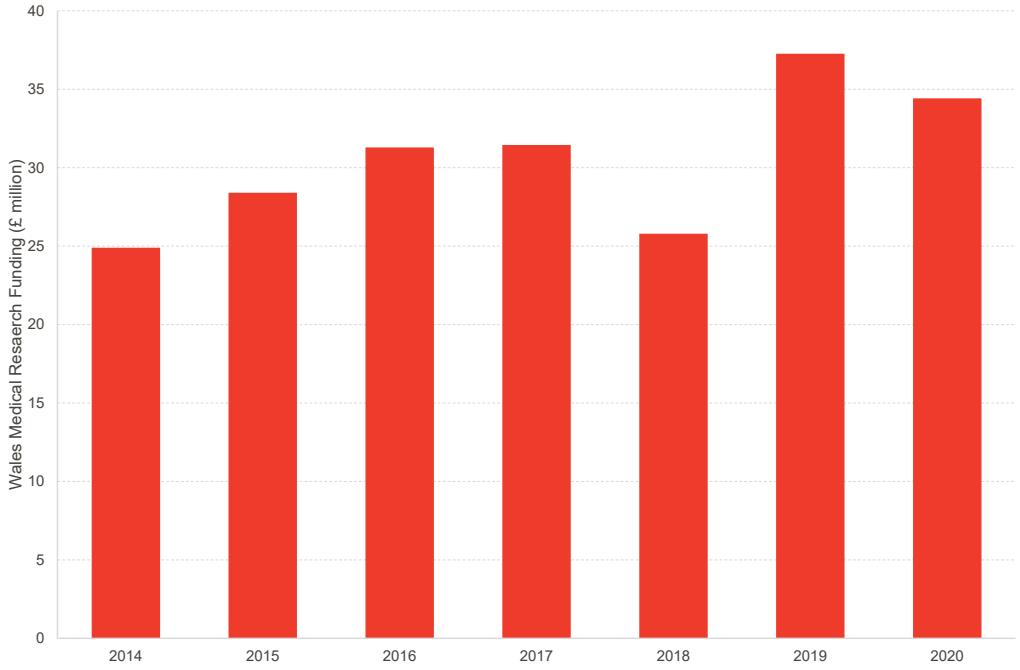
Charities are therefore crucial to the foundation of the research environment that allows for the creation of economic benefit.

Medical research expenditure[7] has increased since 2014, with an estimated £37 million of research funded by AMRC charities in Wales in 2017 compared to £25m in 2014 (Chart 1).

In 2020 Wales experienced a drop in medical research expenditure by charities. Reported expenditure in Wales in 2020 was around £3 million lower than in 2019 – a fall of around 8%. This was directly caused by the pandemic and resulting lockdowns. With charity shops required to close and fundraising events no longer taking place under lockdown regulations, AMRC charities reported a 38% loss in fundraising income between March to May 2020[8].

6 Direct funding as a small amount of charity funding is originally sourced from the public sector itself.
7 This is expenditure by 154 member charities of the Association of Medical Research Charities.
8 See AMRC

Chart 1: Total AMRC medical research expenditure in Wales, £ million, annualised value, 2014 – 2020



Source: *UKCRC, AMRC, FAI Calculations*

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

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

A survey by the Chartered Institute of Fundraising's Welsh division[9] found that two thirds of charities had expected to make cuts to services due to the Covid-19 pandemic. 86% of responding charities had low expectations or no expectations that they would meet their financial targets for the year as a direct consequence of reduced operations. 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, the AMRC[10] highlights the potential long-term implications of the pandemic on medical researchers. They estimate that in 2020 there were 1,750 early career medical researchers or PhD students in the UK, of which two thirds relied solely on medical research funding to support their salaries.

The same research found that the cuts in charitable funding during the pandemic meant 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.

9 See IoF Survey
10 See AMRC

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 researchers. Additionally, in May 2020, the AMRC[11] forecasted that the sector may not return to pre-pandemic levels for four to five years, which may hinder the advancement of medical treatments in the UK and Wales.

Which charities fund medical research?

In Wales, there are currently more than 9,000 charities operating for a wide variety of causes across society[12].

A report by Charities Aid Foundation in Wales[13] found that three-fifths of people in Wales had donated to a charitable cause in 2018, with the top three causes including animal welfare, children or young people and, medical research.

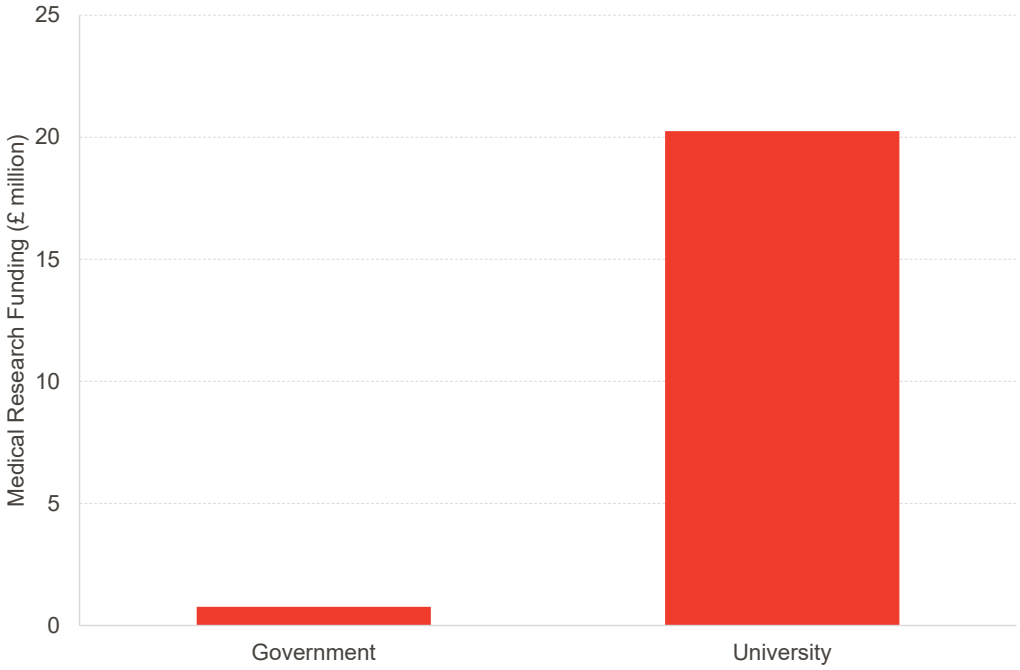
Data provided by the Association of Medical Research Charities, a membership organisation with more than 150 registered charity members, shows that some of the largest members in Wales by funding are:

- The Wellcome Trust
- Cancer Research UK
- Versus Arthritis
- British Heart Foundation

The member charities of the AMRC distribute medical research funding across Wales across several organisations and institutions. The largest type of recipient is universities, receiving 96% of the total value of research grants in 2018, with the remaining funding distributed through the health and social care system and other sources.

11 See AMRC
12 See Welsh Government
13 See Charities Aid Foundation Wales

Chart 2: Research grants by institution



Source: *UKCRC*

The role of universities in Wales

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 recent years, examples of charity-funded medical research conducted by Welsh universities include:

- Research at Cardiff University funded by the British Heart Foundation that explores whether bright spots in pre-natal ultrasound scans can detect heart deformations before birth and treat mothers and babies, to improve health outcomes for families in Wales and the wider UK.
- A project being undertaken at the University of Cardiff, funded by Prostate Cancer UK, looking at the effects of prostate cancer on the immune system to explore how immunotherapies might be used to treat prostate cancer in the future.
- Researchers at Swansea University, in partnership with the Scar Free Foundation, have pioneered technology that allows for the 3D printing of noses and ears for patients who have been born without, or lost, these body parts in a bid to change the lives of people all over the UK.

Life Sciences in Wales

One of the key drivers of R&D in Wales is the growing life sciences sector.

The Welsh Government's prioritisation of the life sciences sector as a key area of growth for the economy, and also the multiple institutions working to boost innovation and collaboration within the sector has helped grow life sciences in Wales. In recent years, the life sciences sector has seen an average growth of 5% year-on-year[14] as the Welsh Government's Life Sciences Hub attracts inward investment and boosts research across all areas of medical research.

In recent years, the sector has seen employment grow to nearly 12,000 people across 300 companies, with annual turnover of around £2bn. As well as this, Wales is also estimated to have 20% more life sciences companies per capita than the UK average[15].

This rapid growth of life sciences has prompted the Welsh Government to establish the Life Sciences Hub, an institution with an aim of boosting innovation and improving collaboration between health, industry, social care, charities and academia.

The creation of the Life Sciences Hub has also not only helped to boost funding by establishing the Wales Life Science Investment Fund and the Life Sciences Bridging Fund, it has also improved collaboration with the creation of the Life Sciences National Research Network.

Both the increased funding and improvement of communication between health, industry, social care and academia has the aim of adding £1bn in GVA to the Welsh economy by 2022.

14 See UK Life Sciences Strategy
15 See Transforming healthcare provision in Wales

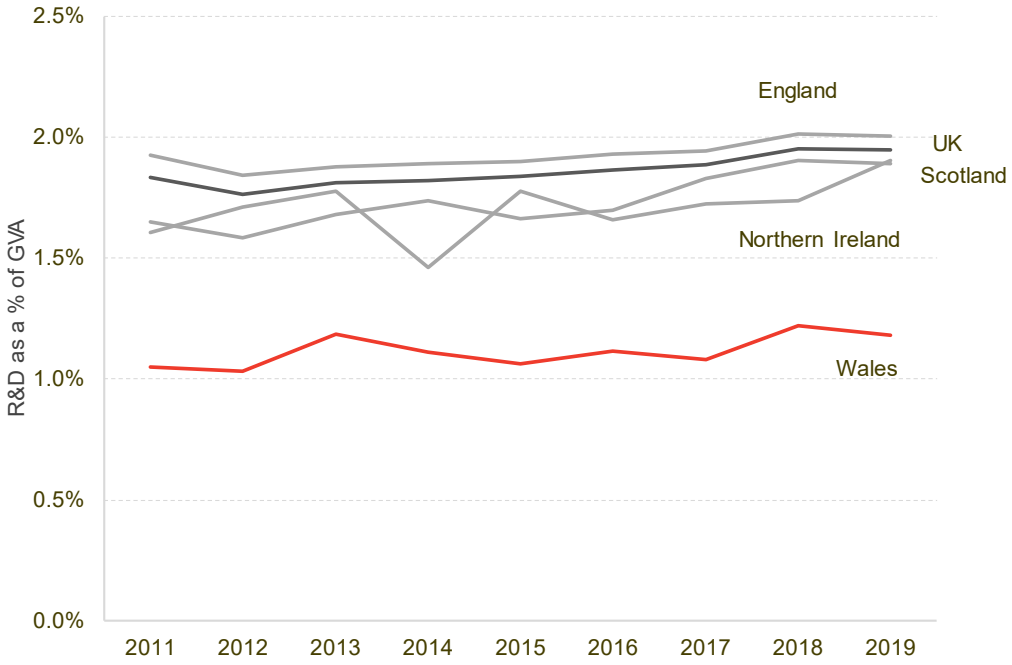
The benefits of medical research and development

How much R&D does Wales perform?

In 2019, total expenditure on R&D in Wales was £794 million, or 1.2% of GVA, Chart 3.

Out of the three devolved nations of the UK and 8 regions of England, Wales has the lowest R&D expenditure as a proportion of GVA.

Chart 3: R&D as a percentage of GVA[16]



Source: *ONS*

The benefits of health R&D

R&D has the ability to boost output and productivity in an economy. As technology advances, we can produce more with the same amount of resources and so productivity improves. And as new methods and technologies are discovered, this knowledge can be used in 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 activity, 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.

16 Note that we have used GVA rather than GDP to calculate this chart. This has allowed for a full time series back to 2011, although the numbers are higher than those seen using GDP as the denominator.

Medical research not only helps to improve overall health outcomes for society but can improve quality of life for individuals. Some examples of successful medical related R&D projects funded by charities in Wales include:

- The Wales Network Centre, in partnership with Alzheimer's Research UK, is a facility aimed at increasing collaboration between Cardiff, Swansea and Bangor Universities to increase the quality and amount of research into Alzheimer's in Wales.
- The creation of the Cardiff Experimental Cancer Medicine Centre (ECMC) is a partnership forged between Cancer Research UK and Welsh Government. The centre aims to improve research into different cancers by improving collaboration between lab scientists and clinicians to improve transition from labs to healthcare settings.

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

As well as benefitting society, charity-funded medical research has wider benefits to the medical research environment as a whole. For example, research by Burridge et. al (2016)[17] 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% creates nearly the same increase in private sector expenditure 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.

17 See Burridge et. Al (2016)

3. Modelling the contribution of medical research expenditure

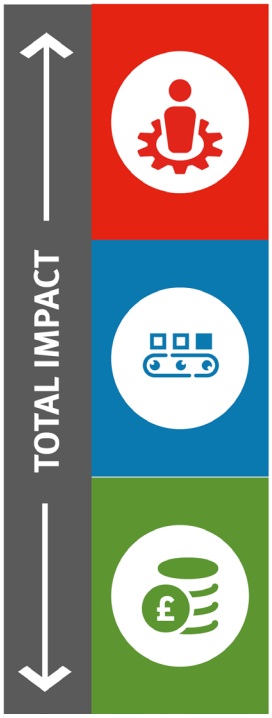
Improving treatments and outcomes for the people of Wales is the priority for medical research. However, medical research expenditure funded by charities also makes a substantial contribution to the economy, supporting economic growth and jobs across the whole of Wales.

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

- Improved levels of health in Wales which help unlock the potential of the workforce, reduce health service costs and improve quality of life.
- The positive knowledge and innovation spill-overs of medical research on knowledge within the private, public and third sectors, which 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 Wales. 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 £53 million output, £34 million GVA and 600 employment in Wales.

Of these jobs, 325 are supported directly in the universities and medical organisations receiving funding, while a further 300 jobs are supported across Wales as a result of spill-over effects.

The pandemic has had a large impact on funding. Medical research funding in Wales provided by charities fell from £24 million in 2019 to £22 million in 2020. As a result, less output and GVA, and fewer jobs were supported by medical research funding by charities in 2020 than in 2019.

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 Wales.

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

	2019	2020
Direct	37	34
Indirect	8	7
Induced	40	34
Total	**86**	**76**

**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 Welsh full-time equivalent jobs, 2019-2020*

	2019	2020
Direct	500	450
Indirect	100	100
Induced	375	325
Total	**975**	**875**

**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 Welsh GVA, £ million, 2019-2020*

	2019	2020
Direct	26	24
Indirect	5	4
Induced	24	21
Total	**55**	**49**

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

Source: FAI Calculations

Economic multipliers

While large industries often have large 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 etc). High multipliers typically describe industries that are strongly integrated with Welsh supply chains and spend significant amounts on wages.

We find that a pound spent by medical research funding by charities likely has a significantly larger impact on output, GVA and employment than the average pound spent in Wales.

Every £1 spent on medical research funding by charities in Wales supports:

- £2.21 of output,
- £1.42 of GVA, and
- 25 employment.

How does this compare? It's difficult to say as the required data for calculating national multipliers is not available for Wales. However, we can compare it to national multipliers seen in Scotland and Northern Ireland. On average across the whole economy, every £1 spent in Scotland or Northern Ireland supports:

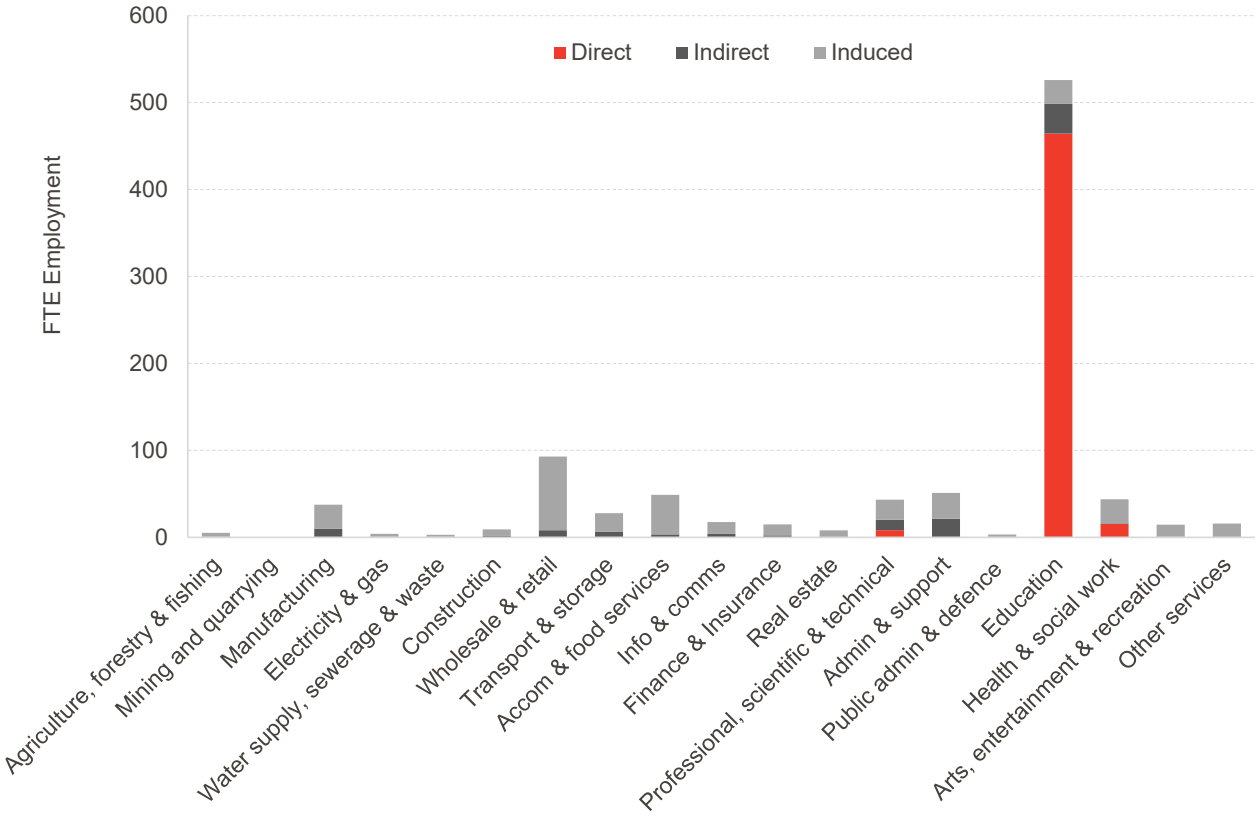
- £1.89 of output in Scotland or £2.18 of output in Northern Ireland,
- £1.04 of GVA in Scotland or £1.15 of GVA in Northern Ireland, and
- 17 employment in Scotland or 19 employment in Northern Ireland.

It is therefore likely that the multipliers of medical research funding in Wales by charities are comparable to sectors with some of the highest employment and GVA multipliers in Wales.

Impact by sector of the Welsh economy

Chart 4 shows the spread of the FTE employment supported by medical research across Welsh industries. Unsurprisingly, the direct employment as a result of medical research funding by charities lies in the education, research & development and health sectors. However, the spill-over impacts extend into many other sectors. For example, medical research funding supports around 90 employment in Wholesale and Retail, 50 in Accommodation & Food Services and 50 in Administration & Support Services.

Chart 4: Direct, Indirect and induced contributions of medical research spending, 2019



Source: *FAI Calculations*

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 grants 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 an 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 is 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 and have made an adjustment to the figures to make them comparable with our Scotland and Northern Ireland reports.

The adjustment reflects that a UK model includes cross border trade. For example, if a Scottish manufacturer purchased machinery from a supplier in England, who in turn purchased metal parts from a supplier in Scotland. Our Scottish and Northern Ireland models count the value as an export as soon as it leaves the nation, and does not count jobs and output supported by the supply chain entering the country again. Therefore, our Scottish and Northern Ireland results should be seen as conservative in this regard – and we have downwards adjusted our Welsh estimates to reflect this cross border trade.

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 wholesale and 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). 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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